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PLANNING FOR AGRICULTURE IN SOUTHERN ONTARIO

Prepared for the ARDA Directorate of Ontario

Under ARDA Project No. 85057

by

The Centre for Resources Development

University of Guelph

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September, 1972.

FOREWORD

The Ontario Ministry of Agriculture & Food and the Canada Department of Regional Economic Expansion commissioned the preparation of this report under the Federal-Provincial Rural Development Agreement. Both governments recognize the need to identify and quantify the demands that will be placed on the supply of agricultural land in the future. Identification of the salient factors will facilitate the formulation of agricultural land use policies to ensure the adequacy of future food supplies and guide Ontario's rural development programs.

Although Ontario generally has a surplus of agricultural land for present food needs, there are strong pressures, particularly near the urban centres of the Province, for the use of high quality agricultural land for such other uses as commercial, residential, industrial and open space. The objectives of this study are:

1) to provide the inputs necessary to decide which areas be committed to agriculture;

2) to identify the key factors affecting agricultural land use and the directions of change over the next twenty years;

3) to determine the interactions between agriculture and the environment; and

4) to suggest priorities and to identify the policy issues and their means of implementation.

The Centre for Resources Development at the University of Guelph has utilized the services of many disciplines for the preparation of this report.

H.F. Crown
Director
ARDA Branch
Ontario Ministry of
Agriculture & Food.

PREFACE

Because of a need to plan for the future of agriculture in Ontario a team of agricultural economists, geographers and soil scientists from the University of Guelph were invited to study the industry, project the changes and suggest guidelines for policy. No one can predict the future in detail. Past efforts to do so seem naive in retrospect. Nevertheless the probable consequences of some of our actions or failures to take action can be foreseen. The authors[1] of this report have attempted to prognosticate agricultural changes over the next twenty years and to provide information which can be used for agricultural planning.

Because of the large numbers of authors and the interdisciplinary nature of the research it was necessary to follow a well regulated procedure. During the project all those concerned met once a week to discuss the research and exchange ideas. As the study proceeded drafts of the various sections were prepared by the appropriate author and discussed at the weekly meetings. The draft reports were subsequently reviewed by the editors Edward Gray, Susan Hemingway and Douglas Hoffman

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[1]John L. Girt, Dept. of Geography, College of Social Sciences;
Edward C. Gray, School of Agricultural Economics and Extension Education, Ontario Agricultural College;
Susan Hemingway, School of Agricultural Economics and Extension Education, Ontario Agricultural College;
Douglas W. Hoffman, Dept. of Land Resource Science, Ontario Agricultural College;
Philip D. Keddie, Dept. of Geography, College of Social Sciences;
Arthur Lerner, School of Agricultural Economics and Extension Education, Ontario Agricultural College;
Julius Mage, Dept. of Geography, College of Social Sciences;
R. Stephen Rodd, School of Agricultural Economics and Extension Education, Ontario Agricultural College;
George Stock, Dept. of Geography, College of Social Sciences;
Willem van Vuuren, School of Agricultural Economics and Extension Education, Ontario Agricultural College.

who were also responsible for the assembly and editing of the final version. This procedure seemed to offer the best means of developing a comprehensive research program and a coherent report about the research activities and results. The project coordinator was Douglas Hoffman.

The contributions made by the authors are as follows:

Chapter 1 - Edward Gray

Chapter 2 - Susan Hemingway, Douglas Hoffman

Chapter 3 - John Girt, Edward Gray, Willem van Vuuren

Chapter 4 - John Girt, Edward Gray, Philip Keddie, Julius Mage, Stephen Rodd, George Stock

Chapter 5 - Willem van Vuuren

Chapter 6 - Julius Mage, Douglas Hoffman, Philip Keddie

Chapter 7 - Arthur Lerner, Stephen Rodd

Chapter 8 - Douglas Hoffman

Chapter 9 - Edward Gray

Appendix - Edward Gray, Stephen Rodd

Although there may be some disagreement among the authors as to the magnitude and specifics of our agricultural problems, as well as the best solutions to them, there is no disagreement about either their urgency or long-range aspects. Complacency, delay and short-range views jeopardize our chances of finding satisfactory solutions. Persistent efforts and flexible plans of long range and large scope will assure the sufficiency and integrity of agriculture. Instead of comprehensive plans what is offered here are some steps toward their early evolution.

September, 1972

J.R. Wright
Acting Director
Centre for Resources Development

ACKNOWLEDGEMENTS

The authors of this report are deeply indebted to all those who assisted during the study. Research of the type conducted requires inputs from numerous sources and we are grateful to those who supplied facts and figures so useful to our work.

A word of special thanks goes to the A.R.D.A. Directorate of Ontario who recommended financial support for the study. The financial support of A.R.D.A. Branch and the Education and Research Division of the Ontario Ministry of Agriculture and Food is gratefully acknowledged. Thanks are also due Mr. H.F. Crown, Director of the A.R.D.A. Branch, Ontario Ministry of Agriculture and Food, whose interest and encouragement were greatly appreciated.

Reginald Hunter of the Assessment Branch, Ministry of Treasury, Economics and Intergovernmental Affairs and Martin Sinclair, Municipal Planning Branch of the same Ministry rendered exceptional help by providing the bulk of the basic data used in our analyses of land values and urban land use. In addition, Reginald Hunter did a large amount of the work connected with data selection of land values.

We wish to thank the following cartographers for their work with the maps and drawings included in this report: Fred Adams, Donald Irvine, and Susan Towndrow, all from the Department of Geography, University of Guelph.

In addition, we appreciate the pleasant and patient assistance of Emily Wilson and Janice Lobdell in the typing of the report.

Finally, and particularly now that it is completed, we are grateful for the opportunity to have engaged in this venture.

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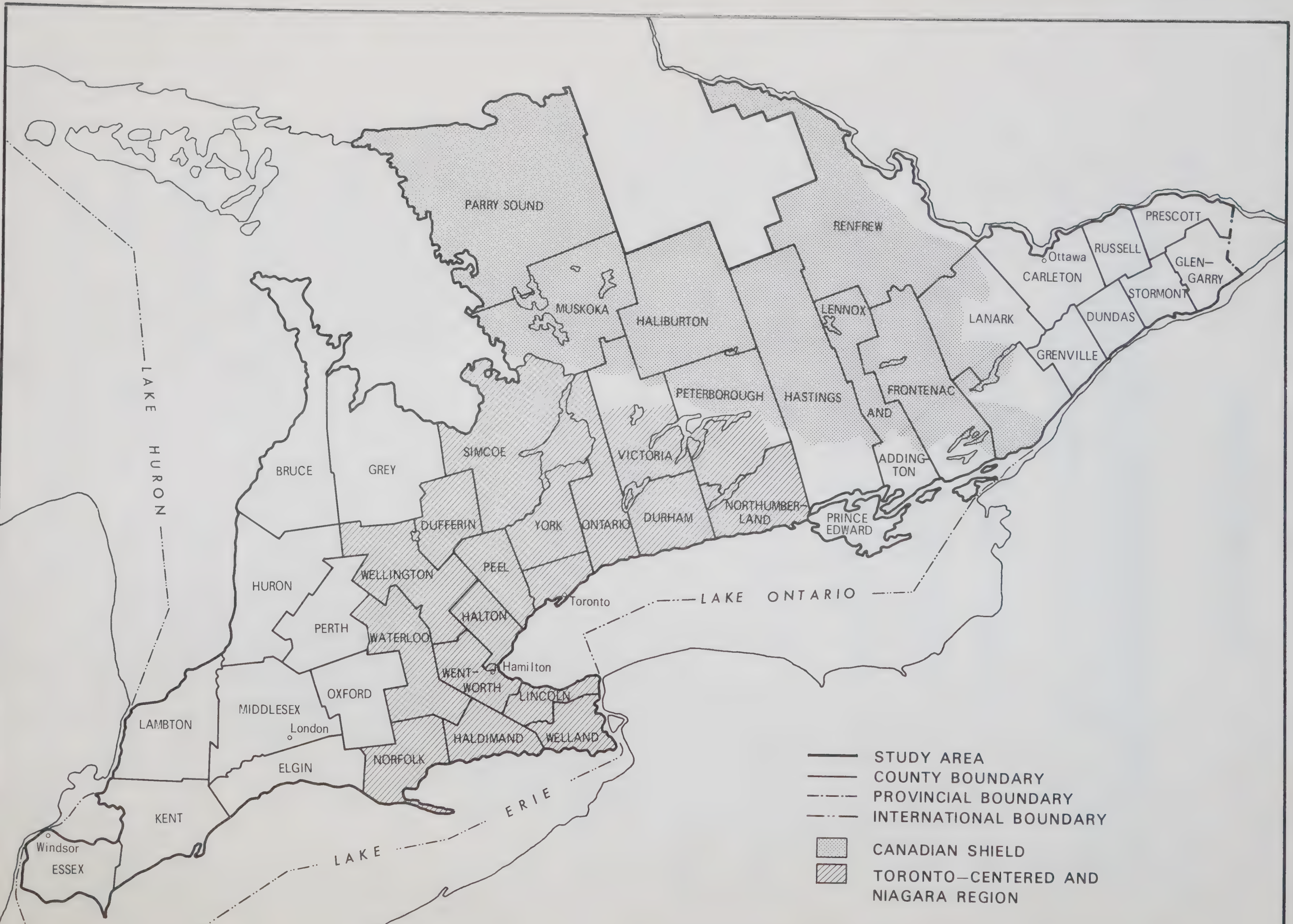

SOUTHERN ONTARIO — GENERAL REFERENCE

CHAPTER 1

INTRODUCTION

TWO ASPECTS OF A CHANGING AGRICULTURE

More than two million acres of land in farms in Southern Ontario were retired during the 15 years between the agricultural censuses of 1951 and 1966[1]. This acreage reduction is equal to nearly one-eighth of the some 18.5 million acres that were in census farms in this part of Ontario in the earlier census year. It represents a continuation of the trend toward contraction of farm acreage that commenced about 1930 when land in farms occupied some 20 million acres.

Preliminary compilations of the 1971 Census of Agriculture indicate that retrenchment has continued since 1966, at a rate of about 10% for this 5-year period[2]. At this level the most recent rate of retrenchment is more than twice the rather constant rate of 4 percent-plus that applied for 5-year intercensal periods between 1951 and 1966, and greatly in excess of 1931-1941 and 1941-1951 rates[3]. Thus a decline in the amount of land occupied by census farms has persisted since 1931 and at an apparently increasing rate.

On the other hand, the annual volume of production from Ontario farms has shown an opposite trend. An index of physical production which

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[1]Unless otherwise noted, "Southern Ontario" in this study comprises the 43 counties and 2 districts extending south and westward from Lake Nipissing and the middle-lower reaches of the Ottawa River.

[2]The percentage decline in census-farm acreages for the entire province was 10.5% between 1966 and 1971. "Southern Ontario" is, however, a large part of the whole: in 1966 its census farms occupied nearly 10 times as much land as was in census farms in "Northern Ontario".

[3]Based on the larger span of 10 years, declines for 1931-1941 and 1941-1951 were respectively 2.2% and 5.9% of the acreage of the earlier census year.

eliminates feed-grain and feeder cattle purchases by Ontario farmers from producers in other provinces, stood at 103.1 in 1951 (base 1949 = 100). By 1966 the index had risen to 156.9, and it reached 163.0 by 1970. Allowing for decreasing acreage, an average 1966 Ontario farm acre had thus increased its physical productivity by nearly 75 percent over 15 years.

The increase in physical productivity that has occurred can be explained in part by technological change in agriculture. This change has been due (1) to the discovery and development of new kinds of inputs and to changes in productivity coefficients, both of which affect existing production functions of individual farm operators, and (2) to the adoption of new techniques which affect the aggregate production function of the community of farmers. In part, per-acre production increases follow from changes in the relative prices of inputs to farming. Principally these are the result of technological change in the agricultural supply industries which bring about substitution among nonland inputs and between these inputs and land. Lastly, production increases per acre are the result of land in an improved state now comprising a higher proportion of the total acreage in census farms -- a consequence of the kind of retrenchment pattern that appears to have developed over the years. This aspect and its implications for the future of agriculture in Southern Ontario is discussed at greater length later in this report.

The increase in the index of aggregate physical output from Ontario farms (net of purchases from other provinces) between 1951 and 1966 kept pace with the increase in Ontario population over the same time. By 1966, both had increased by about 50 percent of 1951 levels although the pattern of increase was by no means parallel. Physical production, for example,

experienced its slowest 5-year growth during 1951-1956 while the rate of increase in Ontario's population slowed progressively every five years over the period from 1951 to 1966.

An index of increases in prices received by Ontario farmers since 1951 has not nearly matched increases in the general level of prices. The index of farm prices in 1966 stood, in fact, at something less than 3 percent above the 1951 index number. By contrast, the simple average of the consumer price index for Toronto and Ottawa increased by 25.7 percent over the same 15-year period. The small overall increase in farm prices is largely explained, however, by the fact that 1951 was a year of exceptionally high prices. If 1950 was used as the reference point, for example, the increase in the index calculates to 22.1 percent[1]. Agricultural product prices at the farm gate in fact declined in Ontario between 1951 and 1955. Over the 10-year period 1956-1966, the index of farm prices climbed nearly 30 percent (whereas consumer prices increased only 21 percent).

Some see overproduction as the root cause of the failure of farm prices to keep pace with the general price level. In its 1969 report, The Challenge of Abundance, The Special Committee on Farm Income in Ontario placed special emphasis (as the title of the report would imply) on the need for "an organized method of production planning in agriculture on a continuous basis . . ." so that the supply of agricultural products might be cleared at satisfactory prices. The report suggested:-

> "Production of farm products has been increasing rapidly in Ontario. Demand has not been growing fast enough to keep farm prices increasing at the same rate as other prices in the economy. The real purchasing power derived from the sale of each unit of farm products has been falling".

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[1]The index of consumer prices was also high in 1951. If similarly calculated from 1950 to 1966, the index is increased to 40%, or nearly double the increase in farm prices over the same time.

Concern on the one hand for the long-run future of agriculture in Southern Ontario because of the level and apparent acceleration in the rate of retirement of its land base is, on first view, directly conflicting with a simultaneous concern, on the other hand, about agricultural overproduction and the unsatisfactory income position it is believed to create. The apparent contradiction of course stems from an assumption that the volume of farm production and the size of the agricultural land base are positively correlated. In other words, progressive diminution in the land area in farms is seen as posing a problem of insufficiency of supply, especially with demand for farm products rising over time due to population increases and rising per capita real incomes. Estimates of the likely increase in the demand for food in Ontario by 1991 are provided in the body of this report. At this stage it is sufficient to mention that there has been no evidence from the facts we have already presented of a positive correlation between an index of physical output and the acreage of land in census farms in Southern Ontario, at least for the 15 years since 1951.

Can we expect the present tension in concern over farmland retrenchment on the one hand, and overproduction on the other, to persist? Might it not be realistic to suppose that the tension is a phenomenon of the present, a condition of temporary unbalance caused by the failure of a corrective system to work itself out fully. If this is the case, should then either reason for concern be the subject of public intervention, say, through the planning process?

Assuming the farm estate in Southern Ontario will continue to diminish (if only because of the strength of nonfarm demands for rural land),

whether the present phenomenon of so-called overproduction will disappear or perhaps become a chronic condition depends upon the prospect of efficient production of more and more farm products per unit of land area -- that is, upon the profitability of securing still higher output per acre in the agricultural industry. It is obviously extremely difficult to predict the future course of events in this area. However, we provide evidence later in this report that the application of selected inputs per acre of land farmed increased in certain areas of Southern Ontario over the period 1951-1966. The assumption that such a trend will continue may, therefore, not be too unreasonable. In any event, there will be considerable scope for making production more land-intensive in the case of some farm enterprises. Whether such a process will be more profitable than a more land-extensive kind of production plan is another matter, of course. Moreover, land intensification brings with it an intensification of pollution problems, whether in the form of increased fertilizer and pesticide residues, or waste disposal and odour problems in the case of concentrated livestock production. Society is insisting on increasingly higher standards with respect to noxious emissions and residues. The costs of meeting these future standards may well mean that the limit of reduction in land as an input to agricultural production is fast being approached for many farm enterprises. Should further concentration of production per land unit become constrained for this reason, the prospect of Ontario's farms eventually supplying a decreasing share of Ontario's requirements for food becomes virtually certain at present rates of farmland retrenchment.

In any event, the possible existence of a corrective system -- that is, a decreasing reserve of arable land eliminating a condition of

"overproduction" -- is not sufficient reason for not instituting public programmes either on the "production" or on the "land" side. For example, the nature of the transfers of land out of agriculture that are occurring may well be socially undesirable (although they could make good economic sense to the farmer concerned). The retrenchment of high quality soils when those less suitable for farming might nearly equally satisfy a new "permanent" nonfarm use would certainly seem to represent a social loss of some considerable magnitude; so, too, might haphazard and otherwise unplanned severance of parts of the farm estate for low density nonfarm residence or, where the land is held in a virtually idle state, for the profits of pure speculation.

Up to this point, we have described only relatively recent changes in the agriculture of Southern Ontario, in terms of capacity to produce. We now look briefly at broad patterns of land-use change in the context of evolving economic growth and consider other roles that may be attributed to agriculture during the development process, or perhaps secularly.

ROLES OF AGRICULTURE AND ECONOMIC DEVELOPMENT

Nations of the New World have commonly assigned to the agricultural community a number of major positive roles. One is the provision of food and fibre for their populations. A second is infusion of political and social stability. The third is occupancy of land that is arable by virtue of soil and climate.

The third role is of some special interest to this study insofar as we have already indicated that the food needs of an increasing population in Southern Ontario apparently are being supplied from progressively smaller

acreages of farmland[1].

Agriculture's occupancy of available land surfaces may be described as an extensive role. As such it has generally been less obvious than the role of supplier of food and fibre, possibly because its pervasive element, area, is easily concealed by food and fibre production which tends to be dominating. In any event, the importance that is attached to agriculture's extensive role is related to a nation's state of development. Early agricultural settlement that pushes back the frontier provisions itself largely through the utilization of natural resources in the form of soil, water, and climate. At the same time it provisions other forms of national expansion such as forestry and mining operations and the construction of railways, roads, and the like. Perhaps most important is the fact that it facilitates an essential discovery and exploratory stage of national development.

Settlement patterns established in the early years are commonly not sustained. Agriculture that has reached, for example, into areas that remain remote from developing market centres (especially where soils also prove incapable of supporting continuous cropping or where rainfall is shown to be unreliable and climate unsatisfactory) begins to experience fundamental difficulties. The deficiencies initially extant tend to increase over time. Farmers become increasingly unable to meet competition from areas that are less distant from markets and whose endowment of natural resources important

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[1]We say "apparently" because we have not investigated changes in the net import of agricultural commodities from other countries or from other provinces of Canada. Data for the latter are difficult to secure except for freight assisted shipments of feed grains from the prairie provinces. These shipments have been somewhat variable over the years. To Eastern Canada as a larger region they were 10% less in 1965-66 than in 1951-52.

to agricultural production is superior[1]. Under conditions of increasing economic disadvantage, the boundary between agriculture and wild lands -- the extensive margin -- eventually contracts.

The outer edge (extensive margin) of agriculture may sometimes be prescribed by natural physical features rather than represent the geographic limit of profitable production where agricultural land rents are zero because of the distance factor. In these circumstances, economic forces that ordinarily explain transfers of land from agriculture to wild land may manifest themselves simply in disparity between outer and inner margins in the intensity with which nonland inputs are combined with land.

Such a situation and its accompanying condition of nonzero agricultural rents at the outer edge appears to exist in Southern Ontario for the most part. First, with respect to physical constraints, we have south and east from Georgian Bay a major lakes system confining a region where soils are of high agricultural quality for the most part. The climate of the region is also generally favourable for farming[2]. In the north of the study area the southern extremity of the Precambrian Shield provides a fairly sharp natural definition of land which presents some prospect of a surplus through farming, from land which presents little or no prospect. Secondly, if we accept Toronto and the urban-industrial lakeshore development nearby as the single most important force in determining the general configuration

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[1] T. W. Shultz, however, would argue that inequality in farm income among regions is not a result of soil or farmer differences, but rather due to the location of the region in respect to major urban centres -- as reported by Lorne H. Russwurm in "Expanding Urbanization and Selected Agricultural Elements: Case Study, Southwestern Ontario Area, 1941-1961", Land Economics, Vol. 43, February 1967, pp. 101-197.

[2] Both the soil and the climatic resources of the entire study area are discussed in some detail later on in this report.

of the margins of agriculture, we find, as discussed later in Chapter 4, a diminishing pattern of intensity in agriculture radial from this metropolis.

Immediately within the outer rather sharply defined edge of agriculture as determined by this elemental arrangement, there is probably no farm abandonment of the kind that is explained by the classical theory of land rent and that is characteristic of the reversion of agriculture to wild lands. That is to say, we do not find farmers literally abandoning their land through inability to pay their creditors and through failure to attract buyers willing to outlay at least the cost of securing a legal title to the property in question. This is so even in the case of those farms that are relatively more disadvantaged at this margin. In fact, it is quite probable that characteristics of the soil and topography that are limiting to agricultural production are commonly features of the landscape that are attractive (aesthetically pleasing) to nonfarm buyers.

Such a combination of conditions would seem to prevail in the "Shield" counties where there was a transfer out of agriculture of more than 20 percent of land in census farms over the period 1951-1966[1]. On the Shield "proper", the shallow soils, less favourable climate, and relative remoteness from metropolitan Toronto here combine so that the zero rent condition characteristic of the classical extensive margin of agriculture is approached. Nevertheless, the land has considerable value in recreation and holds out prospects of speculative gain if no immediate new use is intended. Along the southern edge of the Shield and elsewhere at the extensive margin

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[1]It should be mentioned that most of these counties extend beyond the accepted geomorphological limit of the Precambrian Shield and, therefore, embrace "nonconforming" soil and topographic conditions. Transfers out of agriculture have probably been concentrated within the Shield "proper".

where bodies of water are physically constraining, neither agricultural disadvantage nor amenity value is as great. For the most part, therefore, Southern Ontario agriculture at its outer edge is conducted somewhat intensively.

In the virtual absence of farm abandonment in the classical sense even in poor agricultural resource areas, the reader might question the significance of agriculture's extensive role now that assistance to discovery and exploration during pioneering years of settlement has long since ceased to be relevant. This kind of doubt can be answered by postulating that an importance still attaches to agriculture's extensive role although it now has a new dimension. This is now discussed.

A POSSIBLE NEW DIMENSION FOR AGRICULTURE

A new importance attaches to agriculture by reason of the nature and extent of ownership change that is taking place. As we have already indicated in discussing the extensive margin of agriculture in the Shield counties, apparently there is no dearth of nonfarm buyers for land which is becoming less and less economic to farm but which is scenically or otherwise attractive to the nonfarm buyer seeking relief from a deteriorating urban environment. For the most part, however, we believe this land is being held in an idle or semi-idle state. Either in the hands of the farmer seeking to sell or in the hands of the new owner, the meagre and fragile resource base can be expected to be depleted. In the first case, there will be a reduced incentive to conserve the existing stock of natural resources since the intention is that farm operations be short-lived; and in the second, depletion

will ordinarily be the result of ignorance or inactivity[1]. In the circumstances, a good prospect of finding a new nonfarm owner thus does not reduce or eliminate the social costs of depletion brought about by a contracting agriculture. The reverse, in fact, may be nearer the truth insofar as agricultural retirement is accelerated. There is no guarantee that agriculture will be able to reoccupy at some future time land that it is giving up. That is to say, an active land market at agriculture's extensive margin is no insurance against an irreversible change that may have serious social implications.

It would seem that public policy has an obvious role to play in the circumstances. Social costs associated with a contraction of agriculture at its extensive margin can be reduced by public programmes designed to conserve soil, forests, and other elements of the natural resource base. For this reason the municipal and conservation authority forest programme under the Forestry Act of Ontario is an appropriate action of the provincial government. Similarly appropriate are the plantings of forest-tree seedlings stimulated by the Woodlands Improvement Act[2].

With respect to improving the competitive position of agriculture itself at its extensive margin, farm enlargement and consolidation made

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[1] However, it may be conceded that woodland on farms will be preserved to a relatively high degree to the extent that the farmer realizes the price offered by nonfarm purchasers will often depend upon the size and quality of this farm resource.

[2] The Woodlands Improvement Act and the Forestry Act authorize the Minister of Lands and Forests to enter into agreements with owners of privately-owned woodlands and with municipalities and conservation authorities respectively, for the management of forest lands. In the case of the Forestry Act, grants for the purchase of forest lands are also provided.

possible by the province under the ARDA agreement is, too, consistent with the objective of conserving the resource base. The several ARDA programmes in this area are designed to encourage at least a partial reorganization of an economically disadvantaged industry by offering the farmer a wider range of choices than were previously available. While success in respect to the principal objective of improving the income position of farmers who remain may eventually be shown to be only moderate, the programmes help to preserve agricultural activity and thereby serve to decrease the amount of farmland in the hands of speculators. The potential social costs that would result from the free play of market forces are reduced as a consequence.

PLANNING AGRICULTURAL LAND USE

There is little disagreement at least among economists as to the general ranking of agriculture in a hierarchy of land-use values: even irrigated agriculture is a low-value use of land. In the circumstances and given the conditions under which the present land market operates, agriculture is, therefore, at a disadvantage when it must compete with other higher-value uses for land. It is simply forced to give way.

Irrigation is also a low-value use of water. In regions where water is becoming increasingly scarce, continuing high levels of consumption by agriculture is the subject of a great deal of criticism of the institutions and procedures that allocate water. The same kind of criticism is not evident in the case of land even though its supply is effectively fixed for a given geographic area. The allocation mechanism that operates in the case of land -- the land market -- generally ensures the satisfaction of a higher-value use over a lower-value one.

Competitive or rival demands for land are especially strong in the

vicinity of prosperous urban centres and in the "corridors" that may connect them. Not only must growth from within the urban complex be accommodated, but the land demands that stem from continuing growth in the proportion of the population that resides in urban places must also be satisfied. In these circumstances it might seem that an allocation mechanism that recognized different values in use and accommodated the highest first was a highly efficient one.

There are several reasons why this is not necessarily so. In the first place, a high-value "urban" use may pick off and take out of production prime agricultural land when land of lower quality would have only minor defects and limitations in that alternative use. Moreover, such deficiencies as exist could foreseeably be a temporary phenomenon, able to be corrected at reasonable cost. A large difference in value between farm and nonfarm uses even when agriculture on the best soils is highly profitable will ordinarily imply a weak inclination to seek out savings in the form of slightly lower costs for less-than-prime land. In fact, a reasonable expectation is that any premium paid for prime farmland will be recouped many times over under conditions that presently pertain in the Ontario land market[1].

Secondly, and probably much more important at this intensive margin, is the fact that reallocation of land between agriculture and urban-industrial development will usually be a haphazard, uncoordinated and unsystematic process when it is left largely in the hands of private developers and subdividers. The large difference in value that exists between the two major uses means that the prospect of a high profit from the transfer of uses is good. Farmers, how-

[1]Nevertheless, the tendency for urban uses to pre-empt the best agricultural soils may well be overdone. As a city grows, location will become increasingly important and "infilling" can mean that sites of progressively lower soil quality are eventually occupied.

ever, are not unaware of the gains to be made although ordinarily they will lack the resources and business connections to realize a major share of the value increment (less the direct costs of development and subdivision). As a consequence, the purchase of farmland to accommodate future urban growth will meet different levels of resistance that depend in part upon a farmer's ability to hold out against early offers for his land and his appreciation of the future course of events in the land market -- in particular, his expectation of net benefits to accrue from postponing a sale. In many cases, the direction and configuration of urban advance into the countryside will be determined by an ability of private developers to overcome the fragmentation in reallocation between uses that is inherent in the decision system as it exists -- that is, to assemble land in parcels or blocks of a size sufficient to make the provision of sewerage and other urban services an economic proposition. Even so, the consolidation entailed by this requirement is no guarantee that expansion will be orderly and progressive in respect to the existing stock of development. A "leapfrogging" kind of growth pattern will be the highly probable outcome of the free play of market forces[1]. Development in such a manner imposes high costs on the agriculture isolated between growth nuclei and on the attenuated and scattered collection of urban communities that results.

Thus, an apparently efficient allocative mechanism proves to have serious deficiencies in reality. The need for public land policies becomes as evident at this margin of agriculture as it was shown to be at the margin

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[1]The controls on development patterns that can be exercised by city government should not be discounted entirely. However, the process described typically takes place immediately beyond the area over which the urban municipality has jurisdiction. Later incorporation through annexation is analogous to closing the stable door after the horse has bolted.

between agriculture and the wild lands. For all of this, however, uncertainty with respect to the future land needs of a growing city can never be fully eliminated. Even in the hands of the most competent planners, a substantial reserve of land in transition between agriculture and new use is required as an insurance against contingencies, but also to accomodate "lead" time -- the interval between acquisition and final execution, during which urban servicing and other planning details are finalized. Planning can be said to have been eminently effective if (1) the reserve accommodates a valuable interim use, (2) the differential between farm prices and urban prices for land is reduced to the greatest extent possible, and (3) a high degree of flexibility is maintained.

Estimates of the increases to 1991 in the developed areas of existing urban municipalities of Southern Ontario are given in this study. Calculations are based essentially on published projections of population up to that time and on per-capita developed-area levels, determined by an independent study, that vary with the size of the urban municipality.

These urban-growth increments are small compared to the rate of reduction that has occurred in census-farm acreages. Even allowing for a substantial phasing out of agriculture in counties that lie largely within the zone of shallow soils of the Precambrian Shield, a considerable part of the acreage reduction remains unexplained by farm retirement at agriculture's "inner" and "outer" margins. Explanation lies, in fact, with a transfer of very significant magnitude, from farm- to nonfarm owner, across what might be described as Ontario's agricultural "heartland".

A large part of our task has been directed toward probing and securing a correct perspective of this latter phenomenon. If more recent data

than have been available to us subsequently show no decline in the rate of this kind of transfer, the consequences for agriculture and the rural countryside may be profound. They may indeed be such that policy measures which extend well beyond zoning and property tax relief will ultimately have to be devised.

Whether more far-reaching policy measures for the nonurban estate will be in the public interest or not depends upon the forces that lie behind and the factors that influence the reallocation of land between agriculture and nonfarm interests. Continuously rising rural-land values are an important consideration here and an aspect that is examined at some length in this report. Agriculture's apparent profitability over broad regions of Southern Ontario and its response to changing relative prices and other conditions are similarly important. They are also considered by this study.

Still more fundamental to the understanding of response to changes that are occurring and, thus, of the need to devise appropriate public policies is knowledge of the underlying resource base and structure of agriculture. Aspects such as the quality of its soils; potential conflict with sand and gravel reserves; climate; the allocation of labour between farm and off-farm work; the size of the farm; typical products and enterprises; and so forth, are treated in the chapters that immediately follow.

DATA SOURCES AND LIMITATIONS

This introduction must remain incomplete unless some reference is made to data sources and their limitations.

The four censuses of agriculture between 1951 and 1966 were by far the most important sources of data used in this study. They provided information on various aspects of the structure of agriculture in Southern Ontario

and its change over a 15-year period. In many cases the response of agriculture to forces emanating from both "within" and "without" the industry was determined from the examination of change in important variables included in Census of Agriculture tabulations. Information on the forces themselves was obtained from other statistical series of Statistics Canada, but also from other more diverse sources such as various data-collecting agencies of the Government of Ontario and the published reports of independent researchers (including some attached to the University of Guelph). In one case at least, a data series developed entirely independently of the census enumeration was found. Possibly a significant finding resulted from the comparison of this with the Census data.

A comparison of the profitability of the agricultural industry among different areas of Southern Ontario was hampered by cost data deficiencies. This aspect could only be investigated by comparing rates of change in the price of farmland and by examining different avenues of response as were reflected, for example, by different levels and patterns of substitution among inputs to farming; by changes in product mix; and so forth. The linkage of the census of agriculture and population such as is proposed for the 1971 census data will likely provide more direct information on regional differences in agricultural performance and thus be of assistance to future analyses and planning of agricultural land use in Southern Ontario.

Perhaps even more important in respect to limitations of the data and to the kind of objectives pursued by this study is the fact that there is presently no concerted collection of statistics on the uses (or nonuses) to which land retired from agriculture is being put. Between 1951 and the present, this retirement probably represented more than 20 percent of the acreage that was in census farms in 1951. Until such collection can be organized, a considerable gap in the information system will continue to exist. Accordingly,

a greater measure of uncertainty will surround the formulation of public policies for the rural areas of Southern Ontario and the decisions required as to the most effective tools for implementing them.

THE STRUCTURE OF THIS REPORT

The attempt has been to arrange in as systematic a sequence as possible material prepared by a number of authors on various aspects of the agricultural industry of Southern Ontario.

A description of important characteristics of the population of farms and their resource base is first provided (Chapter 2). This is followed in Chapter 3 by discussion and investigation of the single most important aspect of change that has occurred since 1950 in the agriculture of the study region -- reduction in the acreage of farmland. This retirement of land out of agriculture is examined in terms of differential losses of improved and unimproved land, spatial differences in rates and characteristics of loss, and the level and nature of rival or competing demands.

The view was taken that explanation of the diminishing land base of agriculture in Southern Ontario lay more with the strength of these competing demands by nonfarmers than was it a response to conditions largely internal within agriculture. Different elements of agricultural response are the subject of Chapter 4.

Agricultural land values and the factors that are possibly important in explaining variability across Southern Ontario are examined in Chapter 5. The definition and characteristics of agricultural regions within the study area and discussion of the usefulness of a land-quality inventory to the planning of agriculture are given in Chapter 6. This is

followed (Chapter 7) by a presentation of estimates of the future demand for food and of the relative increase in farm production necessary to satisfy it under different trade assumptions.

Policy guidelines are the concern of Chapter 8. Not unexpectedly, the last chapter contains a summary of findings and the conclusions that have been drawn.

CHAPTER 2

GENERAL CHARACTERISTICS OF FARMS AND THEIR RESOURCES

IMPORTANT FARM CHARACTERISTICS

Before examining the dynamic process of forces and responses which exist in the agricultural system of Southern Ontario, it is important to establish the major internal characteristics of the industry. These have been obtained directly or calculated from the 1966 Census of Agriculture for Ontario. They are presented below, largely in table form.

Almost 90 percent of the land in census farms in Ontario is located in Southern Ontario[1]. More than 95 percent of the provincial capital values for agriculture also originate within this area. Essentially, then, a reference to Ontario's agriculture is, for the most part, a reference to the agriculture of this southern region. Detailed agricultural statistics are not readily available for Southern Ontario as an entity, but in light of this region's contribution towards the provincial economy, a reasonably accurate picture may be obtained from the Census of Agriculture summary tables for the whole of Ontario. Where possible, however, data for Southern Ontario are provided.

Statistics for farm size, tenure and age of farm operators are provided in Table 1. The average size of all census farms in Ontario was about 160 acres in 1966. Nearly 90 percent of the acreage in census farms was owned by farm operators. Nearly 65 percent of census farms were classified as commercial -- that is, with sales over $2500. The average size of this class of farm approached 190 acres. Also,nearly

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[1]For the remainder of this section, Southern Ontario refers to those counties south of Lake Nipissing and the Mattawa River, excluding the 3 counties of Parry Sound, Muskoka and Haliburton.

TABLE 1
Size and Tenure of Farm and Age of Operator
Ontario 1966

	1 Number	2 Area (acres)	1 or 2 as % of total
Number and Size of Holdings			
Number of holdings	109,887		
Area in census farms		17,826,045	
Average size of census farms		162.2	
Median size of census farms		72.8	
Number of commercial farms	70,724		64.4
Area of commercial farms		13,229,561	74.2
Average size of commercial farms		187.1	
Census Farms by Tenure of Operator			
Owner	85,745		78.0
Tenant	4,594		4.2
Part owner	18,913		17.2
Manager	635		0.6
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Total area owned		15,507,615	87.0
Total area rented		2,318,430	13.0
Age of Operator			
Under 25 years	1,865		1.7
25 - 34	13,037		11.9
35 - 44	25,442		23.1
45 - 54	29,199		26.6
55 - 59	13,380		12.2
60 - 64	11,459		10.4
65 - 69	7,884		7.2
70 years and over	7,621		6.9
	109,887		100.0

65 percent of farm operators were 45 years of age or older in 1966.

Land use on census farms for both the whole province and Southern Ontario is provided in Table 2. Nearly 94 percent of all improved farmland in 1966 was located in Southern Ontario. The ratio of improved land to unimproved land was substantially higher in the southern region than in the rest of the province. Almost half of all farmland in the province was under field crops or special crops.

As might be expected, the concentration of capital values is also in Southern Ontario. Total capital value of census farms in this region was greater than $4.5 billion in 1966, of which land and buildings were by far the largest component. Machinery and equipment, and livestock and poultry together accounted for less than 30 percent of total capital value in 1966.

Selected farm expenditures (Table 4) totalled almost $160 million in 1966. Of this rather limited group for which the Census of Agriculture provides data, just over half represented cash wages for hired labour.

Table 5 provides a classification of census farms on the basis of value of agricultural products sold. Of the 70,724 commercial farms in Ontario in 1966, 25.2% reported a product sales value of $15,000 and greater, while nearly 30 percent had sales less than $7,500.

Sales by major product categories and in both absolute and percentage terms are given in Table 6. The major source of farm revenue in 1966 was livestock and livestock products which made up nearly 70% of the total. Cattle and dairy products alone contributed nearly $4.5 million to gross sales, or about 45%.

TABLE 2

Land Use on Census Farms
Ontario and Southern Ontario, 1966

Item	Ontario	% of Total Farmland Ontario	Southern Ontario	% of Total Farmland S. Ontario	S. Ontario as % of Ontario
Number of Census Farms	109,887		102,904		93.6
Area of Improved Land	12,004,305	67.3	11,259,261	71.0	93.8
Under crops	8,358,741				
Pasture	2,935,693				
Summer fallow	229,852				
Other improved land	480,019				
Area of Unimproved Land	5,821,740	32.7	4,607,242	29.0	79.1
Woodland	2,834,417				
Other unimproved	2,987,323				
Total Area of Census Farms	17,826,045	100.0	15,866,503	100.0	89.0

TABLE 3

Capital Value of Census Farms
Southern Ontario, 1966

	Value $	% of Southern Ontario Total	% of Prov. Total for Category
Total Capital Value	4,735,202,900	100.0	97.0
Value of Lands & Buildings	3,353,466,500	70.8	97.2
Value of Machinery & Equip.	722,160,600	15.3	95.0
Value of Livestock & Poultry	659,575,800	13.9	97.8

TABLE 4

Selected Expenditures on Census Farms
Ontario, 1966

	$	% of Total
Taxes (on land and buildings)	41,808,940	26.2
Rent	27,042,340	16.9
Hired labour (cash wages)	91,030,050	56.9
Total	159,881,330	100.0

TABLE 5

Economic Classification of Census Farms
Ontario, 1966

	No.	% of Total Census farms.
Total number of census farms	109,887	100.0
Total number of commercial farms	70,724	64.4
Value of agricultural products sold		
$35,000 and over	4,385	4.0
25,000 - 34,999	3,733	3.4
15,000 - 24,999	9,692	8.8
10,000 - 14,999	11,522	10.5
7,500 - 9,999	9,210	8.4
5,000 - 7,499	13,173	12.0
3,750 - 4,999	8,489	7.7
2,500 - 3,749	10,520	9.6
Total number of small scale farms	39,081	35.6
Value of products sold		
1,200 - 2,499	14,377	13.1
250 - 1,199	14,410	13.1
50 - 249	10,294	9.3
Institutional Farms	82	0.1

TABLE 6

Value of Products Sold,
Southern Ontario[1], 1966

Product	Value ($1000)	Percent of Total Value
Livestock & Livestock Products		
Cattle	258,134	25.4
Dairy products	185,249	18.3
Pigs	134,338	13.2
Poultry and eggs	103,015	10.2
Sheep (incl. wool) and horses	6,815	0.7
Total	687,551	67.8
Field Crops		
Wheat and other grains (incl. oil seeds)	77,196	7.6
Hay and fodder	10,241	1.0
Potatoes, roots, tobacco	117,501	11.6
Total	204,938	20.2
Other Crops		
Vegetables	33,505	3.3
Tree fruits and small fruits	28,998	2.9
Greenhouse and nursery	39,763	3.9
Total	102,266	10.1
Other Receipts	19,266	1.9
TOTAL	1,014,021	100.0
Average Value of Products Sold per Census Farm	9.2	

[1]Includes Parry Sound, Muskoka and Haliburton

The foregoing brief description provides only a static picture of Southern Ontario's agriculture as it existed in 1966. This 1966 position is a result of responses over time to internal and external pressures for change. The source and magnitude of these pressures, and the ability of agriculture to make adjustments will be dealt with in the following sections of this report.

SOILS

Maps of the distribution of soil capability classes for agriculture have been published by A.R.D.A. and are available from various sources. It is, therefore, not the purpose of this report to repeat this information. Instead the information is summarized on the outline maps and its use in planning for agriculture is discussed.

The percentage distribution of class 1 and 2 soils is shown in Figure 1. The greatest amount of classes 1 and 2 soils occur in southwestern Ontario where most townships have more than 75% of their area made up of high quality land. As would be expected areas having a low proportion of class 1 and 2 soils (less than 25%) are located mainly in the Precambrian Shield and the limestone plains. A high proportion of the townships in eastern Ontario have less than 25% of their area in class 1 and 2 soils.

The situation in eastern Ontario shows some improvement when class 3 soils are considered along with the first two classes. Figure 2 shows that most of the townships in the region have 26% to 75% of their area in classes 1, 2 and 3. However, there is no significant change in the townships in Haliburton County or the Districts of Muskoka, Parry Sound and Nipissing. Only a small proportion of these have class 1, 2 and 3 soils.

The acreages of the soil capability classes for that part of Ontario south of Lake Nipissing and the French and Mattawa rivers are given in Table 7. About 10 million acres are classes 1 and 2, and 9 million are non-agricultural (class 7). Of even greater significance

TABLE 7

Acreages of Soil Capability Classes in Southern Ontario

Class	Million Acres	% of Total
1	4.9	15.4
2	4.9	15.4
3	3.2	10.0
4	1.8	5.7
5	1.9	6.0
6	2.2	6.8
7	9.5	30.0
	28.4	89.3
Algonquin Park	1.9	6.0
Organic Soils	1.5	4.7
	31.8	100.0

TABLE 8
Comparison of Corn Yield Means of Different Soil Classes

Class	No. of Observations	Corn Yield Means
1	170	136
2	258	105
3	64	80
4	7	60

These results indicate that corn yield means for soil classes 1, 2, 3 and 4 are significantly different from one another. However, the number of observations on class 4 soils is small and the mean yield may not be as accurate as desired.

TABLE 9
Comparison of Barley Yield Means of Different Soil Classes

Class	No. of Observations	Barley Yield Means
1	39	81
2	29	67
3	37	52
4	16	38

TABLE 10
Comparison of Oat Yield Means of Different Soil Classes

Class	No. of Observations	Oat Yield Means
1	51	90
2	39	73
3	20	62
4	13	52

The results in Tables 9 and 10 indicate that yield means for soil classes 1, 2, 3 and 4 are significantly different from one another. They also show an increase in the number of observations on class 4 soils over the number shown for corn in Table 8. Slightly over 13 percent of the total observations for barley occur on class 4 sites compared with 10.5 percent for oats and 1.4 percent for corn. The larger number of samples increases the confidence in the results shown for class 4 use capability for barley and oats sites.

Because yields for each crop vary among soil classes, some means of establishing equivalents is needed. This has been done by developing a performance index. The index has been prepared by assigning a value of 1.00 to class 1 for each crop and determining a comparative ranking for the remaining classes. Performance indices for corn, barley and oats are shown in Table 11.

TABLE 11

Performance Indices for Soil Classes 1 to 4 Based on Yields of Corn, Barley and Oats

	Performance Indices		
Class	Grain Corn	Barley	Oats
1	1.00	1.00	1.00
2	.77	.83	.81
3	.59	.64	.69
4	.43	.47	.57

The performance indices for each crop on class 2 sites are similar but differences of over 10 percentage points occur on classes 3 and 4. In

spite of the range in values within a class it is possible to develop one set of performance indices which can be applied to all common field crops. This can be done by calculating the mean and standard error for each class. Performance indices for all common field crops are shown in Table 12.

TABLE 12

Performance Indices for Soil Classes 1 to 4 For Common Field Crops

Class	Index	Range[1]
1	1.00	.....
2	.80	.80 $\pm$ .03
3	.64	.64 $\pm$ .04
4	.49	.49 $\pm$ .06

The indices in Table 12 are similar to those developed by Anderson[2] working with birdsfoot trefoil. His indices are essentially the same for classes 1, 2 and 3 but his index for class 4 is slightly higher. It seems that these indices can be used to amplify the definitions of classes 1, 2, 3 and 4 of the soil capability classification for agriculture and thereby fill the need for quantification. Indices for classes 5 and 6 can be obtained from Anderson's work[3]. His results show no significant difference

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[1] 5% significance

[2] J. S. Anderson, The Relationship Between Soil Class and Forage M. Sc. Thesis, University of Guelph, Guelph, 1971, p. 43.

[3] *Ibid.*

between classes 4 and 5 nor between classes 5 and 6. There is a significant difference between classes 4 and 6.

It is evident that cultivatable crops are grown only on classes 1, 2, 3 and 4. Apparently, classes 5 and 6 are used for hay and pasture where agriculture is practised and class 7 has no agricultural use. This supports the grouping of the classes outlined in Report No. 2 of the Canada Land Inventory[1] as follows:

> "The first three classes are considered capable of sustained production of common field crops, the fourth is marginal for sustained arable culture, the fifth is capable of use only for permanent pasture and hay, the sixth is capable of use only for wild pasture, while the seventh class is for soils and land types considered incapable of use for arable culture or permanent pasture."

Based on the yields obtained in this study and the performance indices developed, the definitions of classes 2, 3 and 4 can be amended as follows:

Class 2 -- Soils in this case have moderate limitations that restrict the range of crops or require moderate conservation practices. Yields of common field crops will be 80 $\pm$ percent of those obtained on class 1 soils.

Class 3 -- Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices. Yields of common field crops will be 64 $\pm$ 4 percent of those obtained on class 1 soils.

Class 4 -- Soils in this class have severe limitations that restrict the range of crops or require special conservation practices or both. Yields of common field crops will be 49 $\pm$ 6 percent of those obtained on class 1 soils.

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[1]Department of Regional Expansion, Soil Capability Classification for Agriculture. Canada Land Inventory, Ottawa, 1969, p. 3.

It seemed possible that the yields and therefore the performance indices were location specific and could not be applied to a region as large as Southern Ontario. To test this the southern part of the province was divided into 3 zones and the data for corn was used to compare one zone with another. Zone 1 consisted of the counties of Brant, Wentworth, Welland, Lincoln and Kent, zone 2 included Durham, Northumberland, Peterborough, Prince Edward, Hastings, York, Lennox and Addington, Peel and Simcoe Counties, and zone 3 consisted of the counties of Carleton, Stormont, Russell, Dundas, Glengarry, Grenville, Lanark and Leeds. Multiple regression analyses show little change in the prediction equation from zone to zone. Nor do the equations for the zones vary from that derived for the whole of Southern Ontario. Analysis of variance shows some variability in mean corn yield and standard error for each class between zones. Mean yields by zone are presented in Table 13 for purposes of comparison.

TABLE 13

Mean Yields of Corn by Zone and by Class

Class	Zone 1	Zone 2 Mean Corn Yields (bu/acre)	Zone 3
1	138	133	137
2	106	102	109
3	77	82	81
4	64	59	62

The variability of mean corn yields between zones is slight. It seems evident that the quantitative expressions suggested for the definitions of classes 2, 3 and 4 as applicable to all of the experimental area may indeed by applicable to very large regions.

SAND AND GRAVEL DEPOSITS

Sand and gravel acreages were computed from previously prepared estimates of soil types taken from the published soil survey reports in Southern Ontario. These acreages were listed by township and the resulting percentage calculations based upon the township unit.

There was no attempt made at estimating the depth of any of the deposits since the purpose of the report was to discuss the possibility of land use conflict between quarrying and agriculture. Since agricultural conflict must be expressed in terms of surface area removed all the acreage data and maps express area not volume.

For specific information about the variety and extent of sand and gravel deposits and quarrying and the quality of the materials recovered the reader is referred to the excellent reports by the Ontario Department of Mines (Industrial Mineral Reports No. 11 - 1963; No. 29 - 1969; No. 38 - 1971)[1].

Guidelines of the Report

The following limitations apply to the data and the calculations and maps based on the data.

1. Acres of sand and gravel deposits were calculated from Soil Survey reports mapped at the following scales: a) the majority 1" to 1 mile; b) 1" to 2 miles; c) 1" to 1 1/2 miles.

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[1]Hewitt, D. F., and Cowan, W. R., 1963: Sand and Gravel in Southern Ontario 1963; Ontario Dept. of Mines, I.M.R. 11, 151 p. Accompanied by 5 maps.

Hewitt, D. F., and Cowan, W. R., 1969: Sand and Gravel in Southern Ontario 1967-68; Ontario Dept. of Mines, I.M.R. 29, 105 p. Accompanied by 1 map.

2. The numerical data on township acreages was rounded off to the nearest 100 acres, e.g. 149 acres was rounded to 100 acres.
3. All calculated percentages were rounded to the nearest whole number, e.g. 78.3% became 78%.
4. Unless specifically stated the unit for map comparison is the township.
5. No estimate has been made of the sand and gravel reserves listed where building, urbanization, or zoning by-laws have virtually removed the possibility of sand and gravel quarrying.
6. No value judgements have been made as to the advisability of quarrying or not quarrying any listed reserve.

Observations:

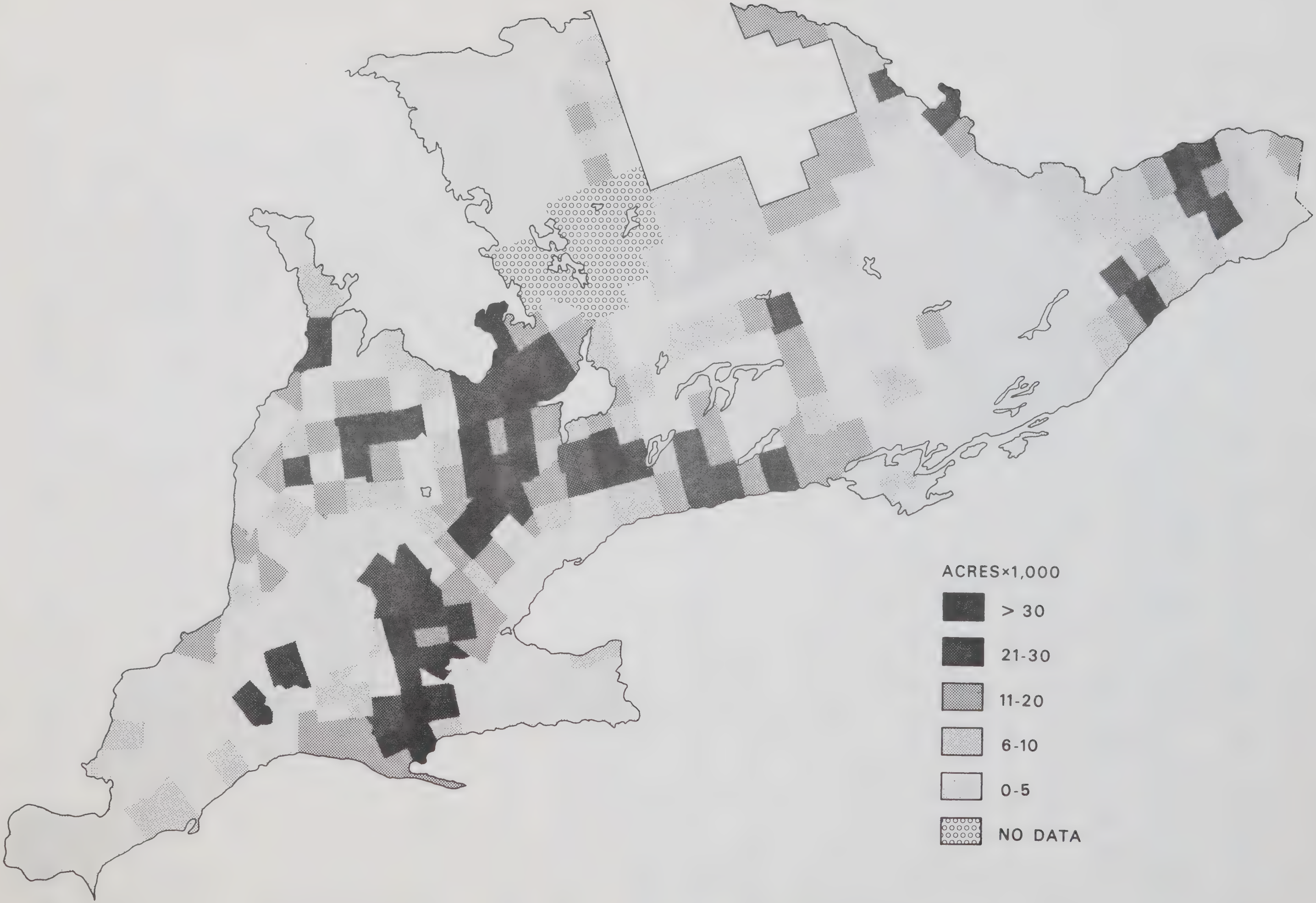
1. FIGURE 3 - ACRES OF SOILS (BY TOWNSHIP) UNDERLAIN BY SAND AND GRAVEL (1000 acres).

Central and south central Ontario, particularly the Toronto-Centred Region contain the highest sand and gravel acreage reserve. Acreages of sand deposits show the same trend.

Table 14- Of the 435 townships for which there was data, 45% of these contained 5000 acres or more; however, within the Toronto-Centred Region of the 99 townships present, 69% contained 5000 acres or more.

2. FIGURE 4 - ACRES OF SOILS UNDERLAIN BY SAND AND GRAVEL EXPRESSED AS A PERCENT OF TOTAL SOIL ACRES.

Sand and gravel reserves were expressed as a percentage of the total soil acreage of the townships in order to get an impression of the areas where the sands and gravels formed a significant amount of total township area - the assumption being that significant conflicts between quarrying and other land uses may result in areas where the reserves are



ACRES OF SOILS UNDERLAIN BY SAND AND GRAVEL

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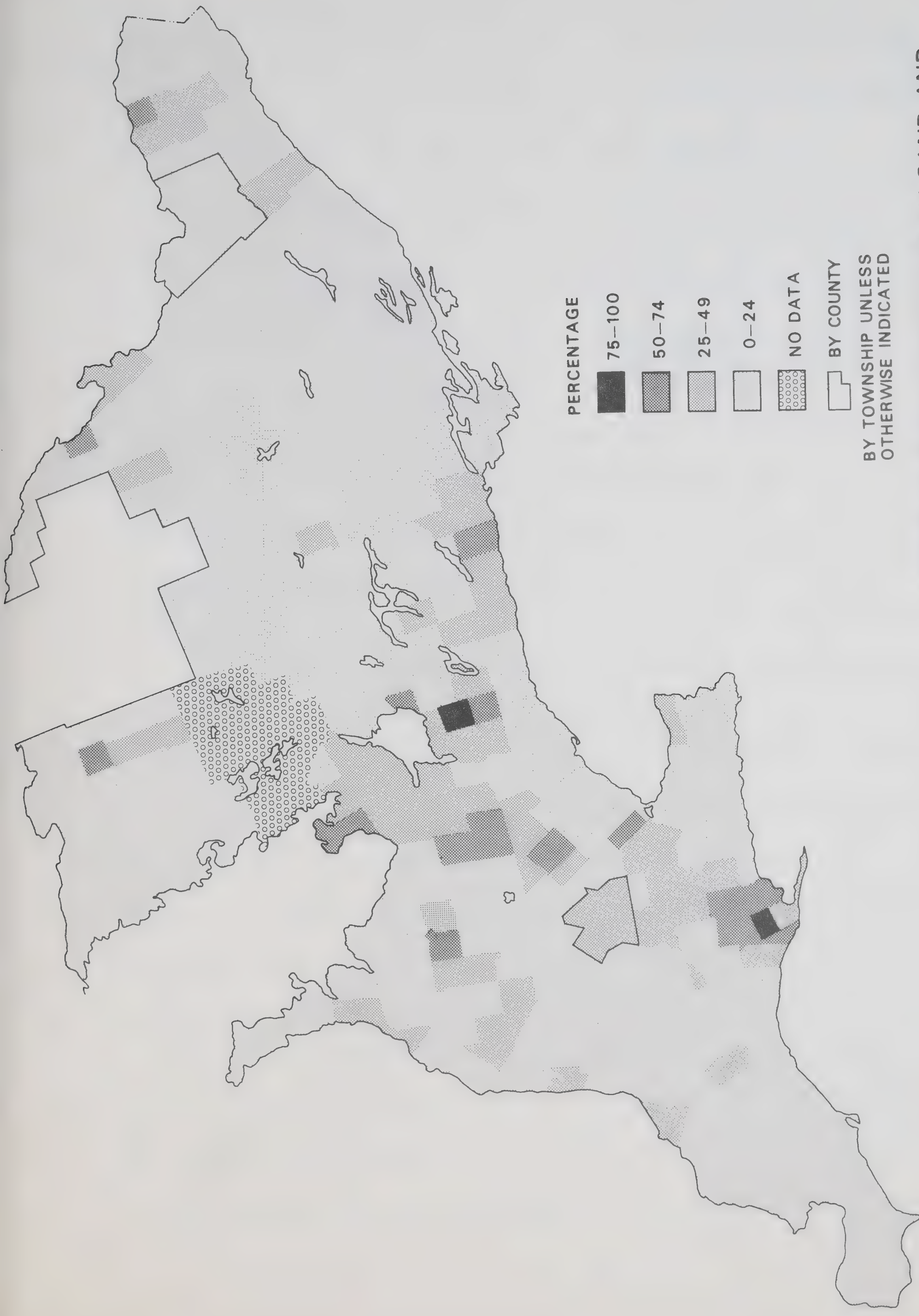

ACRES OF SOILS UNDERLAIN BY SAND AND GRAVEL AS A PERCENTAGE OF TOTAL SOIL ACRES

4

high. With the exception of several townships in eastern Ontario, western Ontario and south central Ontario, the majority of the townships containing 25% and greater reserves fall into the Toronto-Centred Region.

A truer picture of the conflict potential between agriculture and quarrying should be found from comparisons of the amount of good agricultural land underlain by sand and gravel to total township acres, to total sand and gravel soil acres, and to total acres of class 1 and 2 agricultural land. The rationale for choosing only class 1 and 2 agricultural land results from considering the conclusions drawn from a study of crop yields vs. land class[1].

The study demonstrated that there was at least a 20% drop in efficient productivity between class 1 and class 2 agricultural land. Therefore, for the purpose of the report class 2 agricultural land was deemed to be the lower limit of acceptable agricultural land and only quarrying which may remove class 1 and 2 land from productivity was considered to be a conflict with agriculture.

3. FIGURE 5 - ACRES OF CLASS 1 AND 2 SAND AND GRAVEL SOILS AS A PERCENTAGE OF TOTAL SOIL ACRES.

Figure 5 shows that any significant conflict between agriculture and quarrying (on a township basis) is limited to the fringe area between south western and south central Ontario, and in particular to the counties of Waterloo and Brant. Thus, although the acreage reserves (Figure 3) are widely distributed throughout certain areas in Ontario, and although there is a concentration of sand and gravel reserves within the Toronto-Centred Region (Figure 4) the potential conflict between agriculture and

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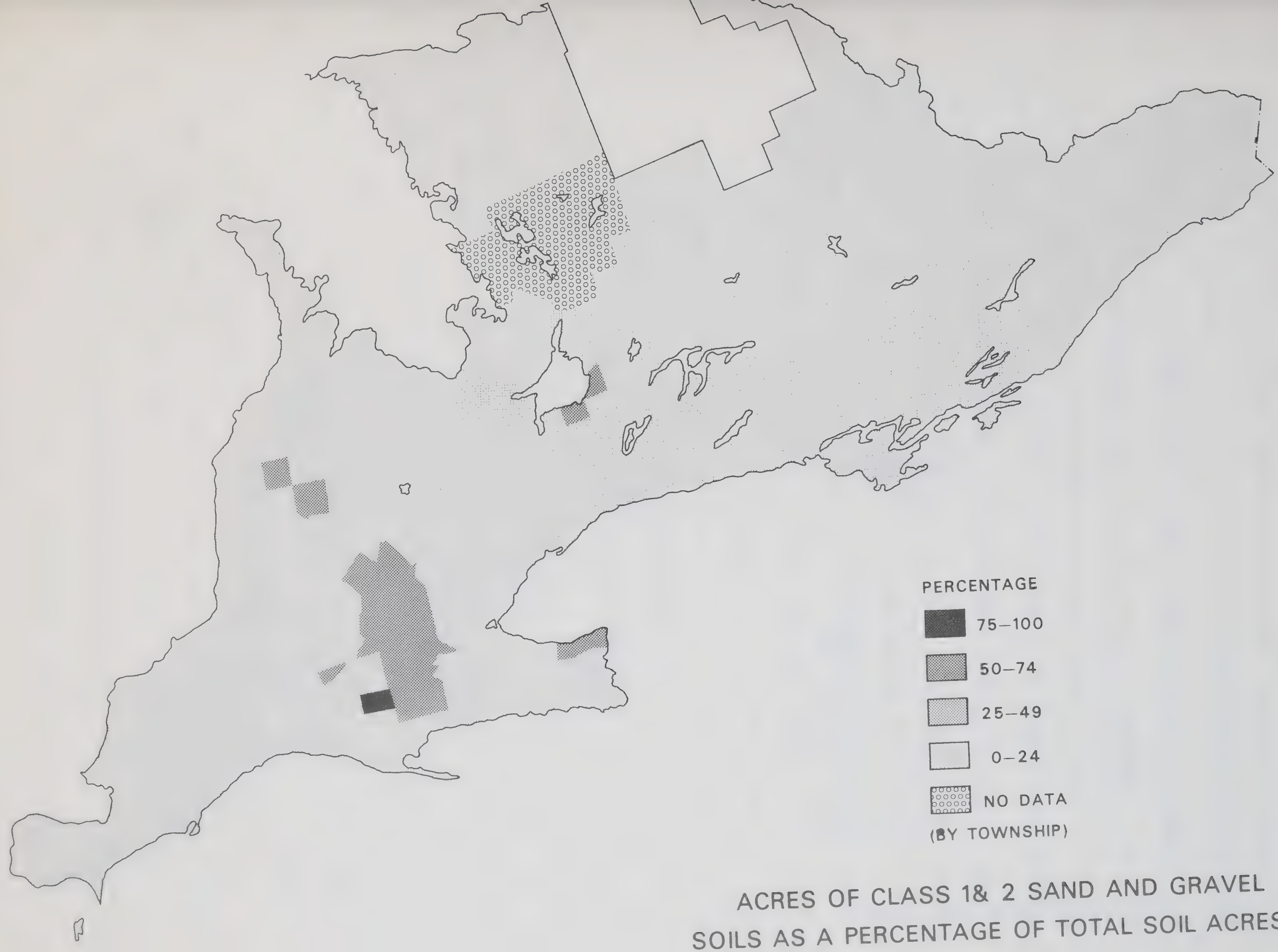
[1] D. W. Hoffman, A.R.D.A. Report #4 - The Assessment of Soil Productivity for Agriculture.



ACRES OF CLASS 1& 2 SAND AND GRAVEL
SOILS AS A PERCENTAGE OF TOTAL SOIL ACRES

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quarrying is limited. This does not mean, however, that there will be no conflict between the two operations as may be seen in Figure 4.

4. FIGURE 6 - ACRES OF CLASS 1 AND 2 SOILS UNDERLAIN BY SAND AND GRAVEL AS A PERCENTAGE OF TOTAL ACRES OF SAND AND GRAVEL SOILS.

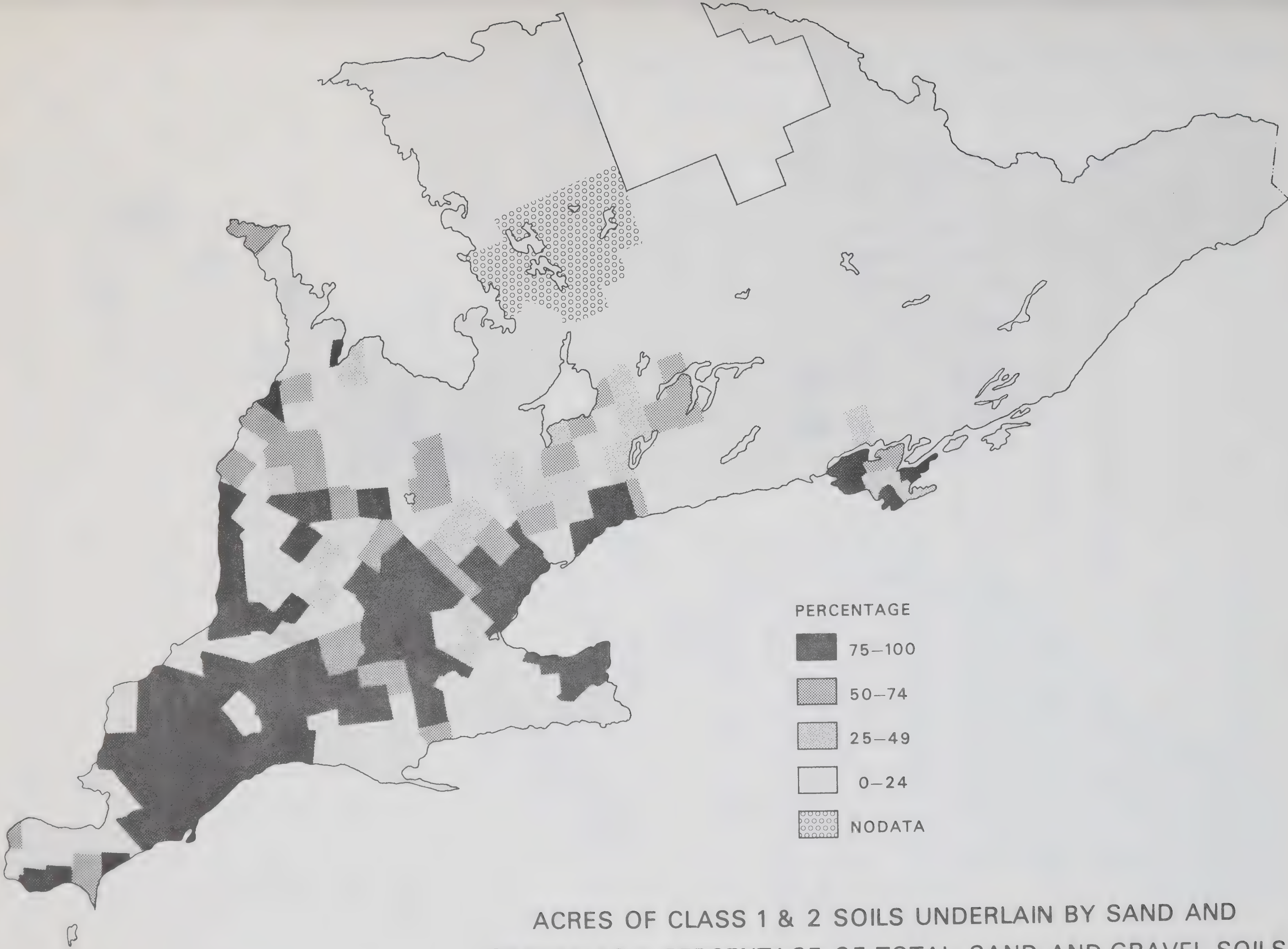
Figure 6 shows that southwestern and south central Ontario contain a large number of townships where the total number of acres of class 1 and 2 sand and gravel soils exceed 75% of the total acres of sand and gravel in the township. Thus, if any quarrying is done there will likely be a conflict with agriculture. It should be pointed out, however, that many of the townships listed contain less than 5000 acres of sand and gravel and if these townships are not considered in the percentage calculation then Figure 7 is the result.

5. FIGURE 7 - ACRES OF CLASS 1 AND 2 SOILS BY TOWNSHIPS UNDERLAIN BY SAND AND GRAVEL, AS A PERCENTAGE OF TOTAL TOWNSHIP ACRES OF SAND AND GRAVEL - TOWNSHIPS HAVING 6000 ACRES OR LESS EXCLUDED.

The Toronto-Centred Region

As previously suggested, (Figures 3 and 4) the Toronto-Centred Region contains a higher proportion of sand and gravel reserves than does the rest of Southern Ontario. For this reason, and because it has been designated as a development area for Southern Ontario, it was felt that a closer look at its reserves and its potential for land use conflict was warranted.

Table 14 compares the percentage of townships in Southern Ontario, and the Toronto-Centred Region which contain greater than 5000 acres of sand and gravel - total and class 1 and 2 for sand and gravel (but also for sand separately and gravel separately). As well the



ACRES OF CLASS 1 & 2 SOILS UNDERLAIN BY SAND AND GRAVEL AS A PERCENTAGE OF TOTAL SAND AND GRAVEL SOILS

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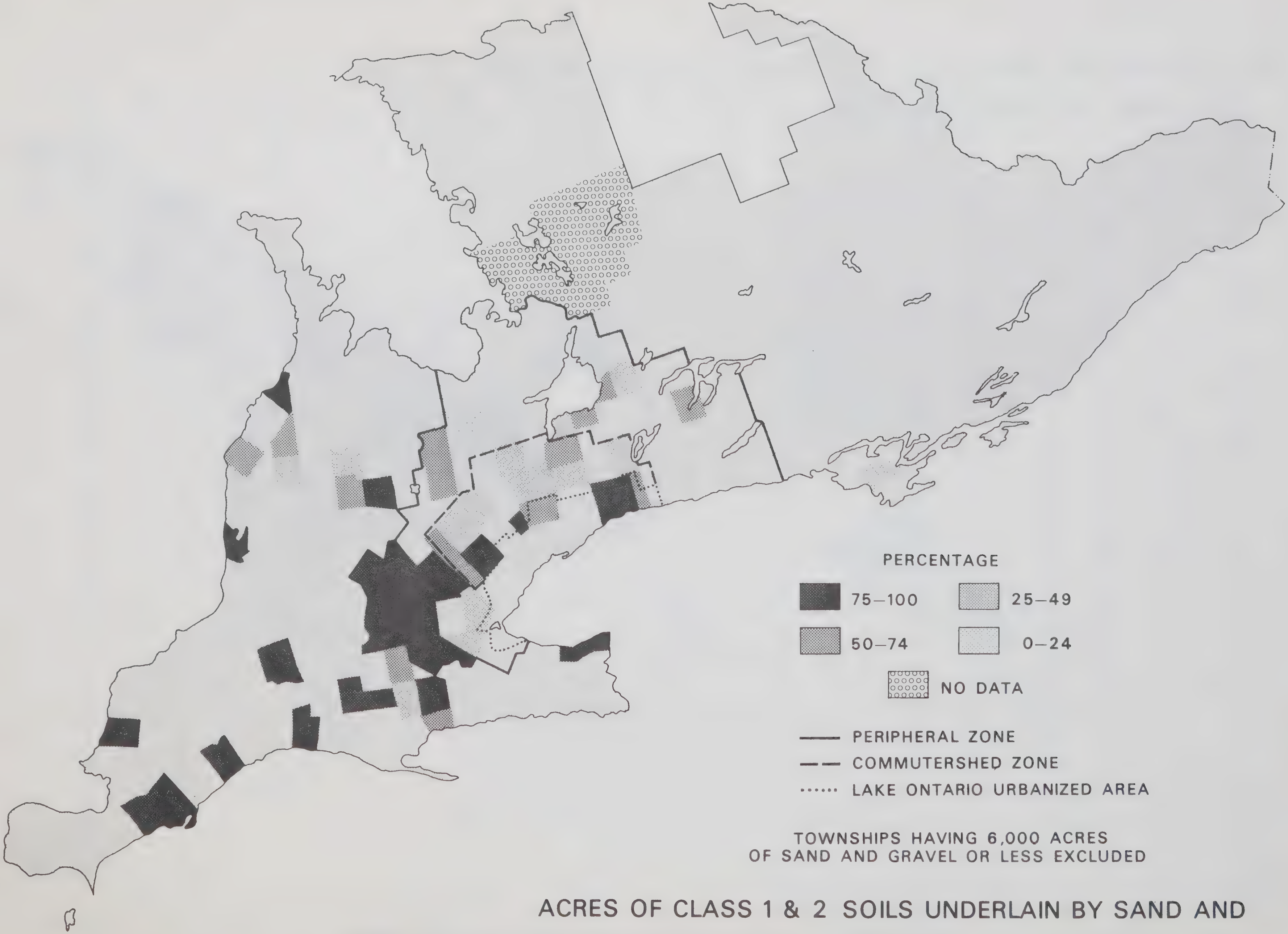

ACRES OF CLASS 1 & 2 SOILS UNDERLAIN BY SAND AND GRAVEL AS A PERCENTAGE OF TOTAL ACRES OF SAND AND GRAVEL SOILS

7

Toronto-Centred Region is divided into the proposed development zones (Design for Development - The Toronto-Centred Region - May 1970) and each zone is appraised.

Three major trends are evident namely:

a) In each of the 3 Major material classes, i.e. Sand and Gravel - Sand etc. there is a significant drop from total to class 1 and 2 in the proportion of townships containing 5000 acres or more. (Two exceptions zone 1 Sand and Gravel total to class 1 and 2 - an increase and zone 2 Gravel - total to class 1 and 2 remains the same).

b) In each of the six material classes (i.e. Sand and Gravel total, Sand and Gravel class 1 and 2 etc.) there is a significant increase from Southern Ontario to the Toronto-Centred Region in the proportion of townships containing 5000 acres or more.

c) In each of the six material classes there is an increase from Zone 1 to Zone 2 followed by a decrease from Zone 2 to Zone 3 of the proportion of townships in each zone containing 5000 acres or more.

In light of the foregoing observations the following conclusions are suggested within the following guidelines:

i) the choice of the 5000 acre level was based upon an observation that a) over half the townships in Southern Ontario fell into this group for sand and gravel total acreages (the percentage was 70% and 84% respectively for sand alone and gravel alone) b) the figure of 5000 represents an acreage value which is 10% or less of the majority of townships in Southern Ontario. The assumption implied then, is that a 5000 acre area does not constitute a significantly large area of a township - hence, while a land use conflict may result on the 5000 acres which are available it is not considered to be significant in respect to the entire township acreages.

TABLE 14

Sand and Gravel Deposits 5000 Acres and More:
Comparisons Between Southern Ontario and the Toronto-Centred Region

Material Classes	Sand & Gravel Total	Sand & Gravel Under Class 1 & 2 Land	Sand Total	Sand Under Class 1 & 2 Land	Gravel Total	Gravel Under Class 1 & 2 Land
% Townships in Southern Ontario with 5000 acres or more	45	13	30	6	14	7
% Townships in the Toronto-Centred Region with 5000 acres or more	69	27	64	20	33	20
% Townships in Zone 1. Toronto-Centred Region with 5000 acres or more	48	35	30	24	24	18
% Townships in Zone 2. Toronto-Centred Region with 5000 acres or more	94	77	82	35	30	30
% Townships in Zone 3. Toronto-Centred Region with 5000 acres or more	71	29	65	17	27	20

Total number of townships in the Toronto-Centred Region = 99; Zone 1 = 17; Zone 2 = 17; Zone 3 = 65.

% Townships in Toronto-Centred Region vs. Southern Ontario = 99/435 = 23% (2 significant figures).

The conclusions drawn from Table 8 are as follows:

1. Since there is a proportionate rise in the percentage of townships in each containing class 1 and 2 land from Southern Ontario to the Toronto-Centred Region the potential for quarrying conflicting with agriculture is higher in the Toronto-Centred Region.

2. Within the Toronto-Centred Region Zone 2 has the highest proportion of townships containing 5000 acres or more total or class 1 and 2 material and therefore has the highest potential for quarrying conflicts with agriculture.

Conclusions 1 and 2 have stated that there exists a potential for quarrying conflicting with agriculture but this does not mean that such a conflict will necessarily occur.

The Design for Development - The Toronto Centred Region - May 1970 stated that:

page 6 i) Zone 1 - "the lakeshore urbanized area is that zone which encompasses the Metropolitan core itself, plus reasonably adjacent urban settlement".

page 15 By the year 2000 it is expected to hold 5.7 million or 71% of the Region's 8 million people.

Clearly then it would seem highly unlikely that quarrying within Zone 1 would conflict with agriculture since ultimately little or no agriculture will be feasible in this area.

page 6 ii) Zone 2 - "the commutershed is that zone beyond the lakeshore urbanized area but within easy daily commuting range of employment in Toronto".

page 20 "Our policy for the commutershed is to retain it to the maximum degree in recreational, agricultural, and other open space uses".

page 27 "By the year 2000 the area should contain (is expected to) only 4.5% of the population or approximately 300,000".

As well because of the "high cost of providing sewer, and water services" it was decided to reserve this area for "largely non-urban uses" (Page 20).

page 6 iii) Zone 3 - "<u>the peripheral zone</u> is that belt beyond the commutershed which is still well within the orbit of highly specialized influences of the Metropolitan core".

If the Design for the development of the Toronto-Centred Region coincides with the suggested three zone development it seems unlikely that there will be a significant number of acres reserved for agriculture in Zone 1 and therefore any quarrying which is done will likely conflict more with non-agricultural uses. Since Zone 2 has been reserved for "recreational, agricultural and other land uses" there is the possibility that quarrying within this area may conflict with agriculture.

Indirect Observations

Unfortunately, many quarrying operations in the past have left the pit areas unsuitable for other land uses including agriculture. It is, however, possible to return a quarry site to agriculture provided a few simple precautions are taken. If the top soil is carefully removed and graded, then stored, it can be replaced on the pit floor after the quarry material has been removed. Thus the pit site or sections of the pit site can be returned to agricultural production after a few years of quarrying.

There exists the potential for indirect loss of agricultural land caused by quarrying. Such loss may come to agricultural land which is close to a quarrying operation but which itself is not underlain by sand

and gravel. The existence of the quarry may itself bring economic pressure to the area for rezoning of the land, or the quarrying may attract other activities such as building or industry to the area which will bring pressure for a rezoning of the area. If the land is rezoned from rural to urban then the chances of agricultural land within the rezoned area remaining productive are greatly diminished.

CLIMATE

The climate of Southern Ontario has been described in detail by D. M. Brown, G. A. McKay and L. J. Chapman in "The Climate of Southern Ontario", a report published by the Canada Department of Transport, and in numerous other reports by these and other authors. It is not the purpose of this study to repeat this information but to briefly describe some of the major climatic zones and the risks involved in the production of particular crops.

Southern Ontario's high agricultural productivity is mainly the result of a favourable climate. It permits the growing of a variety of agricultural crops from common field crops to certain tender fruits. Not all areas are equally productive, however, since the climate is varied.

In general there is little risk attached to growing most grain crops and forages anywhere in the province. Winter wheat may be affected in parts of the Precambrian Shield where ice formation causes winter kill. Other crops such as grain corn, beans, tomatoes, soybeans and peaches are more susceptible to frost damage and the risk of damage is reduced when these are grown in areas close to the Great Lakes. The Lakes regulate the climate near their shores moderating extremes of heat and cold and extending the growing season in autumn. Extremely cold temperatures of -21^{o}F or less, although not unusual in some regions, have never been recorded in the Niagara fruit belt and for this reason peaches may be grown there with confidence.

Seventeen regions of distinctive, fairly uniform climate have been defined by Brown _et_. _al_.[1] which are, perhaps, more numerous than

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[1] D. M. Brown, G. A. McKay and L. J. Chapman, _The Climate of Southern Ontario_ Climatological Studies No. 5, (Ottawa: Dept. of Transport), 1968, p. 6.

necessary for this report. The six regions of greatest significance from our point of view are shown in Figure 8. These include the following:

1. Niagara Fruit Belt
2. Lake Erie Counties
3. South Slopes
4. Dundalk Upland
5. Muskoka - Haliburton
6. Sudbury

The Niagara Fruit Belt has been delineated because it is the only place in the province where peaches can be grown with little risk due to frost. Although peaches are also grown in the Lake Erie Counties region there is a greater risk of crop failure and of temperatures cold enough to kill the trees.

Most other tender fruits can be grown without risk in the Lake Erie Counties region. In fact some parts of the region are well established fruit growing areas and one of the best known is in the vicinity of Leamington. Others occur around Forest, in Norfolk County and near the Lake Ontario shore in Durham, Northumberland and Prince Edward Counties. The Lake Erie climatic region has a climate that is well suited to the production of grain corn, peas, beans, soybeans, tomatoes, tobacco and a number of other cash crops. At one time it was the only region where these crops could be grown with minimum risk of frost damage. However, today, because of a vigorous plant breeding program, these crops can be just as successfully grown throughout the region (shown in Figure 8 as the South Slopes) as in the Lake Erie zone. For example flue-cured tobacco is grown in Simcoe County and in the vicinity of Pembroke in Renfrew County with little significant change in either productivity or quality from that grown in Norfolk County that can be attributed to climatic differences. Similarly corn and soybeans can be grown in the

South Slopes region with little significant lowering of yield due to cooler climate than that in more southerly climatic regions.

Heavy snowfall and cooler temperatures make the Dundalk Upland a risky region in which to grow grain corn, soybeans and other similar crops. There is even some risk attached to growing winter wheat in this region. As a result the most common crops are those that are more hardy such as oats, barley, potatoes, silage corn, grasses and clovers.

Cool climate also reduces the number of crops which can be successfully grown in the Muskoka - Haliburton region. Indeed, the very small amount of arable soils combined with the dangers of frosts make this a comparatively poor region in which to conduct agriculture.

Southern Ontario has warm summers, mild winters and a long growing season with usually reliable rainfall. Such a climate favors the growing of forage and grains, of fruits and vegetables and the production of livestock. A wide choice of crops may be grown including corn for silage and grain, tobacco, soybeans, white beans, canning crops and fruit in addition to the hay, pasture, oats and barley of the general farming and livestock areas. Most of these crops can be grown in that part of Southern Ontario south of the Precambrian Shield with the exception of the region around Dundalk with little risk of crop failure. The best climate for peach and grape production occurs in the Niagara region.

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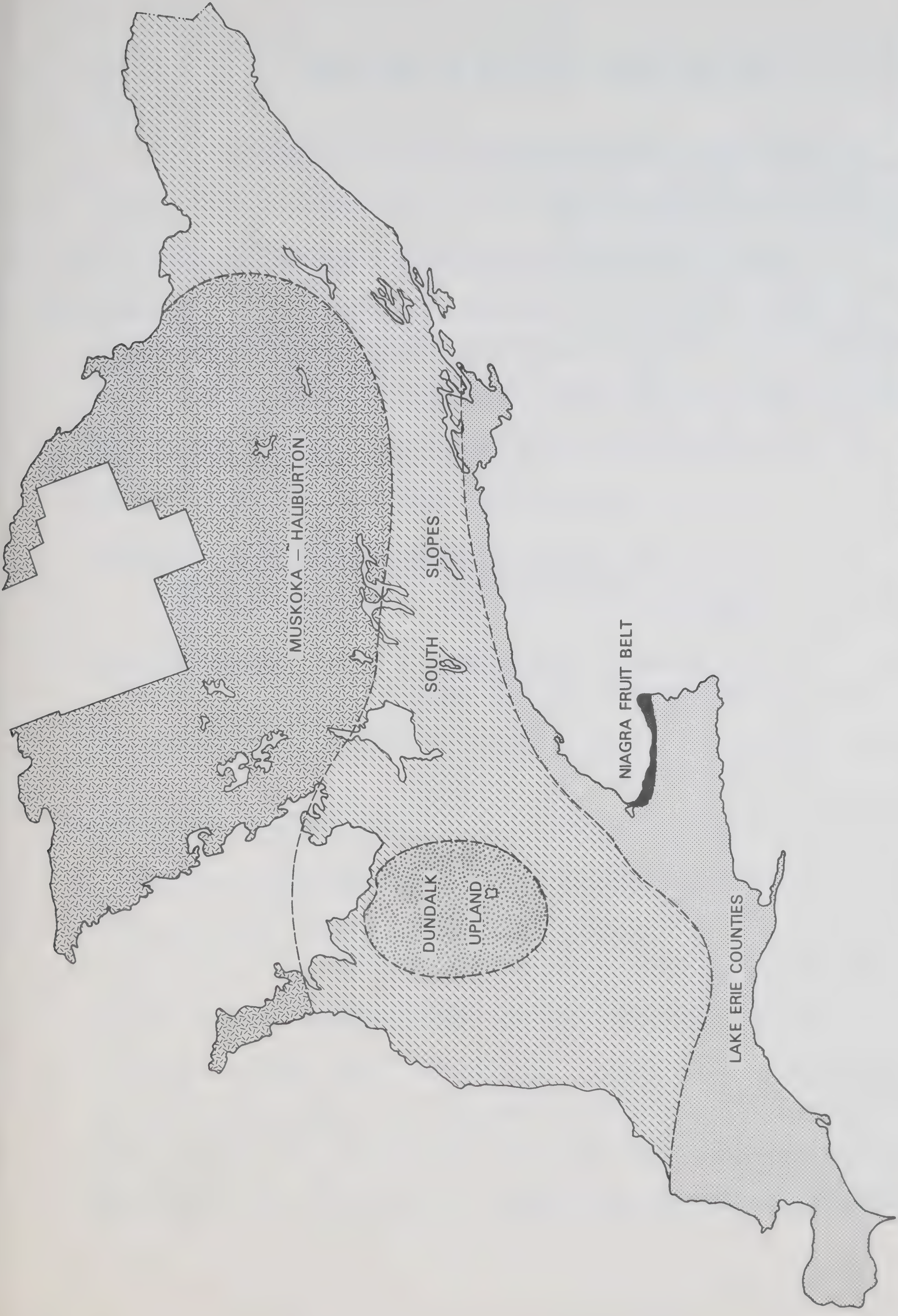

SOME CLIMATIC ZONES OF SOUTHERN ONTARIO

CHAPTER 3

THE DIMINISHING LAND BASE OF AGRICULTURE

THE NATURE OF CHANGE IN AGRICULTURAL LAND USE

Explanations of Recorded Change

Change in the principal categories of land use on farms recorded by the Census of Agriculture - improved and unimproved land - can occur in a number of ways. Acreage differences in these two broad classes for different censal years can be the result of:

1. the retirement out of agriculture of whole operating farms
2. the sale of parts of operating farms to "nonfarm" buyers
3. the incorporation within census-farm boundaries of land never previously in agriculture, or if previously used agriculturally, not counted in recent agricultural censuses
4. the conversion of unimproved land within census farms to improved land, and vice versa
5. a change in the definition of terms
6. some combination of the above.

Some of these possible reasons or explanations of acreage change over time will be less important than others in describing and understanding the real dynamics of Southern Ontario agriculture. For example, acreage difference caused by the change in definition of a census farm for the 1961 Census does not represent the working out of any force or set of forces. The fact that a new definition was adopted simply means that change calculated for the period 1956 - 1961 has to be interpreted with a considerable degree of caution. The analysis of change over the longer period 1951-1966 is, of course, less affected. The influence of

change in the definition of a census farm is discussed elsewhere in the report.

Explanation (3) above is probably of minor importance in actuality. High present costs of clearing and developing land never previously farmed mean that this reason for acreage change is probably only theoretically interesting. There is little evidence that movement of land out of census farms has occurred in some prior period followed by compensating movement back during a later period (or later periods). We are left, therefore, essentially with a consideration of explanations given as items (1), (2) and (4) above.

Importance of Explanatory Source

Aggregate census data for the 45 counties comprising Southern Ontario indicates that both the absolute and relative decline in improved land in census farms between successive census years since 1951 has been less than the corresponding decline in unimproved land. In percentage terms and for the full period 1951-1966, the acreage of improved land has declined by 4.6%; unimproved land, by 26.2%. Expressed in absolute figures, the net "losses" have been about 550,000 acres and 1,725,000 acres, respectively. In the circumstances, is it important to the task in hand if particular causal factors among the residual three - (1), (2) and (4) - carry very high explanatory weights?

Obviously it is. For example, if the diminished census-farm acreage in 1966 is explained largely by (1) when entire farms being retrenched have about an "average" ratio of improved to unimproved land, then the proportion of improved to unimproved land that existed in 1966

requires that nearly 1,000,000 acres of unimproved land on the census farms remaining would have been worked into an "improved" condition[1].

It can reasonably be assumed that the better land on a farm will ordinarily be worked in preference to the poorer, and that unimproved land will usually be agriculturally inferior to improved land. Conversion from unimproved to improved thus carries the implication that agriculture will be under increasing disadvantage as higher percentages of "marginal" land are farmed.

On the other hand, the sale of predominantly unimproved sections of farms to "nonfarmers" provides a handy explanation of decreasing farm acreage that was associated with a rising percentage of improved land in total farm acreage. Agriculture as an entity could be expected to be less disadvantaged in these circumstances -- possibly even to experience net economic gain in the event, for example, that only a minor adjustment in farm operations and enterprises was required, and opportunities, previously denied because of inadequate financing, were then able to be exploited.

Comparison of Census- with Lands and Forests Data

The relative importance of each source of explanation can only be determined by surveys of individual farms. Such surveys were outside the scope of the study. Nevertheless, judgement in their absence is aided by an independent source of data with which comparisons can be made. In our case, this was provided by Lands and Forests (L & F) data

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[1] Even if the ratio was reversed - that is, double (and not half) the acreage of unimproved to improved land on whole farms retrenched - nearly 250,000 acres of unimproved land on remaining farms would have to have been converted to improved. In 1966 this ratio (1:2) was exceeded only in the case of Haliburton, Muskoka and Parry Sound counties.

compiled from aerial photographs (taken mainly in the early 1950's) and published in Forest District Reports.

An estimate of the acreage of developed agricultural land for (almost) all townships of Southern Ontario was part of the L & F data. Good agreement with the acreage of improved land on census farms was found in many cases after L & F estimates had been adjusted for discrepancies in county total land acreages between the two data sources. Agreement was particularly close in the case of three counties - Waterloo, Oxford, and Haldimand -- as the following data shows.

County	"Improved" agr. land - Census as % of L & F acreage	Township data - Range of % difference
Waterloo	99.4	1.0 to 3.4
Oxford	101.4	0.7 to 9.6
Haldimand	96.8	0.6 to 13.0

For the other 38 counties of Southern Ontario for which comparison of the two sources of data was possible, agreement ranged from "poor" to "very good" according to the rather arbitrary rating system devised. The results of the comparison using this classification are given in Table 15 and mapped in Figure 9.

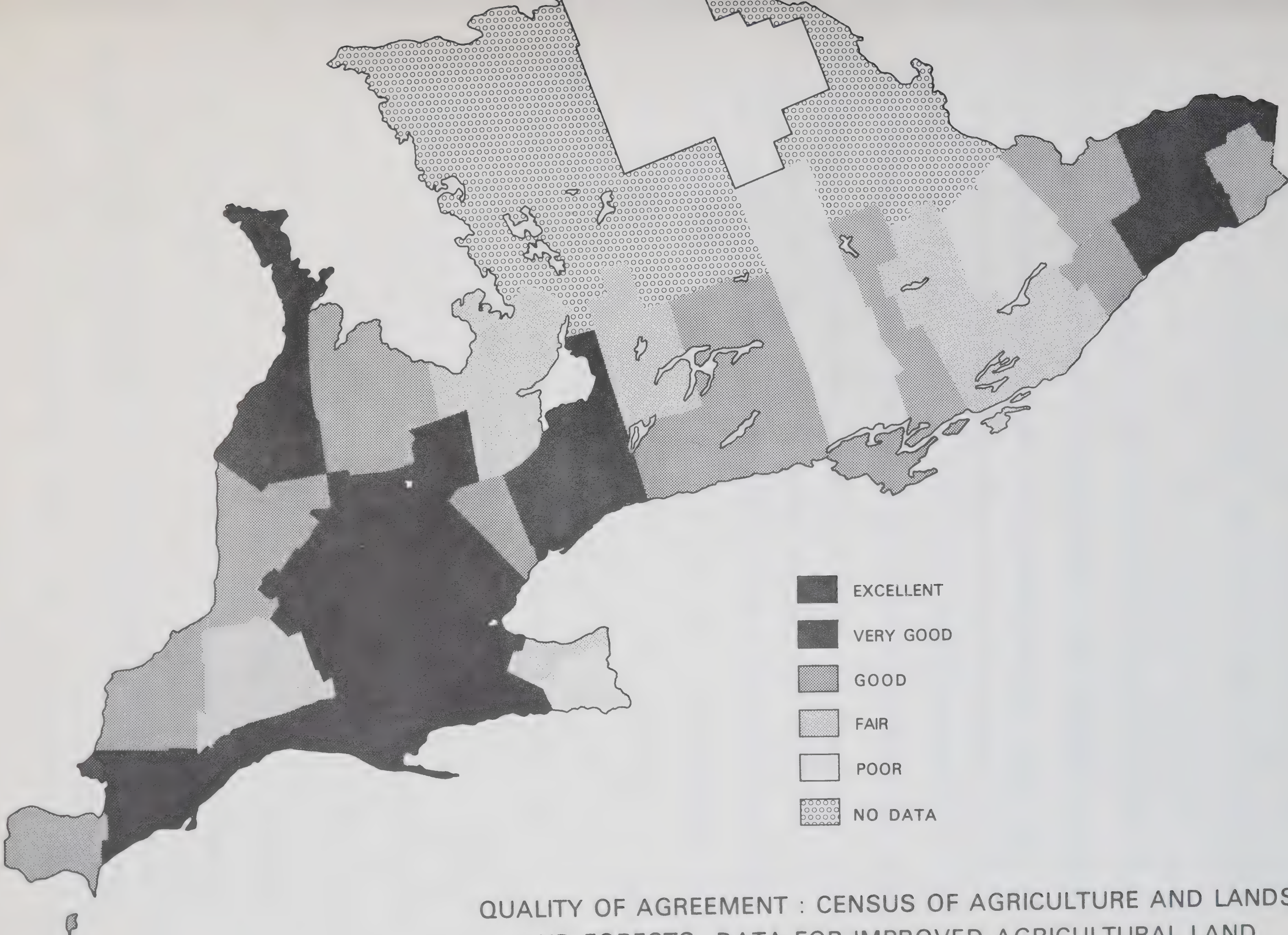
It will be noticed that the two data sources best agree in the case of (a) counties adjacent to Toronto and extending south to the shores of Lake Erie, and (b) the easternmost counties. With respect to (a), agreement is not as good for counties (except Bruce Co.) further

TABLE 15

Selected Counties of Southern Ontario Classified According to Agreement Between Two Estimates[1] of Improved Agricultural Land

Agreement Level				
Excellent	Very Good	Good	Fair	Poor
Haldimand	Brant	Carleton	Frontenac	Lanark
Oxford	Bruce	Durham	Hastings	Welland
Waterloo	Dufferin	Essex	Leeds	
	Dundas	Glengarry	Lincoln	
	Elgin	Grenville	Middlesex	
	Halton	Grey	Simcoe	
	Kent	Huron	Victoria	
	Norfolk	Lambton		
	Ontario	Lennox & Add.		
	Perth	Northumberland		
	Prescott	Peel		
	Russell	Peterborough		
	Stormont	P. Edward Is.		
	Wellington			
	Wentworth			
	York			

[1]Census of Agriculture, either 1951 or 1956; and Lands & Forests data from aerial-photo interpretation.



QUALITY OF AGREEMENT : CENSUS OF AGRICULTURE AND LANDS AND FORESTS DATA FOR IMPROVED AGRICULTURAL LAND

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west toward Lake Huron or further east in the Niagara Peninsula. A lower level of agreement occurs for "Shield" counties taken as a group.

Reasons for Disparate Results

Even with perfect coincidence between what is meant by "improved land" and "developed agricultural land", acreage differences between the two data sources can be expected to the extent that improved land on farms that did not qualify as "census" farms is included in the L & F data. More important in a condition of change is the fact that recording dates were dissimilar between data sources. For example, aerial photographs used by L & F to estimate developed agricultural land were never taken in a single year which was a Census Year. Rather, the photographic record was spread over a number of years only one of which may have been 1951 or 1956[1].

Different Dates of Record

The date of photography generally preceded the year of the census for a number of Forest Districts. There was some tendency for counties which contained 70% and more of their townships characterized by L & F (developed agricultural land) acreages exceeding Census (improved land) acreages, to be found in these forest districts. This would be an expected result where improved land in farms was being "lost" at a steady rate and where, in addition, a tendency existed for interpretation from aerial photographs - the basis of L & F data - to regard, as developed, agricultural land that had recently been retired from farming. The latter is quite likely.

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[1]Whether the 1951 Census or the 1956 Census was selected for comparison purposes depended upon which was the closer in time to the period of photography.

Generally speaking, however, difference in the date of record appeared to have no substantial and predictable effect. For example, L & F data for the ten counties comprising the Lake Huron Forest District were estimated from aerial photographs in 1954 and 1955, say, on average 1.5 years before the census enumeration in 1956[1]. Acreages for this group were generally in better agreement with corresponding census acreages than was the case for other district groups[2]. Needless to say, a time difference of less than two years on average could be expected to have little effect when the rate of change in improved land was low.

On the other hand, the fairly symmetrical bracketing of the census year by the period of photography was not necessarily associated with good agreement between the two sets of data. By and large, "Shield" counties fell in this category. As has previously been mentioned, "agreement" for this group was at a low level.

Results of Data Comparison

Comparison of the independent data sources in fact suggested the existence of:

1. a measure of stability in the inventory of improved farmland in some agricultural regions of Southern Ontario,
2. uncertainty with respect to what is intended by the concept of "improved" or "developed" land and, therefore, considerable disparity in the measurement of improved land by the Census

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[1]The counties are Brant, Bruce, Grey, Halton, Huron, Oxford, Perth, Waterloo, Wellington, Wentworth.

[2]For the 10 counties in question, totals differed only by about 30,000 acres in nearly 4 million acres - that is, the variation was within 0.8%.

of Agriculture and of developed land by L & F, when farming is practised extensively.

Neither, of course, can be regarded as a definitive conclusion because of the quality and the nature of the data available.

Discussion of Comparison

Census data since 1951 and 1956 confirm the low order of net "loss" of improved land in some agricultural regions of Southern Ontario over 5-year intervals. For example, improved land in census farms declined only 2.65% over the 15-year period 1951-1966 for the group of 10 counties comprising the Lake Huron Forest District as a whole[1]. These data, however, have nothing to say as to the origin of the relative stability in this region -- that is, as to whether it lies in offsetting retrenchments and recruitments to the base of improved land (either as an intrafarm or a suprafarm phenomenon), or as a result of relative constancy in the amount of improved land within a farm. By their nature and of themselves, L & F data must similarly be silent. Notwithstanding, a characteristic of the comparison of these two series provides an insight into the question. This characteristic concerns the fact that the method by which "improvement" was determined was radically different between the data sources. Its significance is now explained.

The conversion of unimproved land to an improved state can ordinarily be expected to take time and to proceed through a series of intermediate development stages. If a significant programme of upgrading of this kind had been in train in the early 1950's (to offset a nearly

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[1]If Halton and Wentworth Counties are excluded because of their proximity to Hamilton and the intensive urban development at the western end of Lake Ontario, net loss for the remaining seven counties calculates to only 1.03% over the 15 years.

equal loss of improved land for whatever reason), it is reasonable to expect that difficulties of photo interpretation of the staging process would have worked against good agreement between data sources. Moreover, interpretation difficulties would have extended to the retrenched improved land. As previously explained, L & F data would have tended to include at least part of this acreage. The collection of Census data, similarly, could also have been expected to have been affected by a condition of relative stability that was maintained by offsetting retrenchment and recruitment. Under the circumstances, agreement that was the result of the rough balancing of the invalid "inclusion" in L & F data of improved land already retired, by a more conservative interpretation of the state of improvement of lands being recruited, would seem to have been highly unlikely at best.

An explanation of agreement that relies on relative constancy over time in the acreage of improved land within a farm is much more tenable for regions experiencing minor net change in improved agricultural land[1]. Furthermore, a characteristic of such constancy can help explain the much lower order of agreement that was found between Census and L & F estimates of "improved" land in "extensive" agricultural regions (such as "Shield" counties) compared to regions where agriculture is practised more "intensively" (such as most counties of the Lake Huron Forest District). The characteristic in question relates to improvement in the latter kind of region representing a considerable investment in past years of both capital and labour such that identification of what is improved - and what is unimproved land is clearcut.

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[1]This is not meant to deny that the same constancy may also exist for counties experiencing relatively higher net losses of improved agricultural land.

It is our opinion that investment as described is one of the distinguishing features of regions of Southern Ontario which have a history of profitable farming. Moreover, we postulate that a reluctance-to-sell that is associated with this investment helps explain the fact that in these regions the ratio of "improved" acreage losses to "unimproved" is persistently different from the ratio that applies to the farmland remaining. Only where urban influence is manifested in consolidated losses of farmland -- for example, to subdivisional and industrial development on a large scale -- as opposed to the more insidious kind of erosion to rural residence, does the ratio of "improved" acreage loss to "unimproved" more nearly approach the ratio that applies over the remaining agricultural estate. These tentative hypotheses are now examined, the first by investigating possible indifference to selling improved land in a region where agriculture is "extensive" -- that is to say, where it has been a less profitable venture and the "improvement" process has, in consequence, been curtailed.

Eleven counties which were illustrative of "extensive" agriculture were selected. These were: Parry Sound, Muskoka, Victoria, Haliburton, Peterborough, Hastings, Lennox & Addington, Frontenac, Renfrew, Lanark and Leeds. An additional eight counties where consolidated urban loss was most likely were also selected: Welland, Lincoln, Wentworth, Halton, Peel, York, Ontario and Carleton. Percentage losses of total farmland by improved and unimproved categories are given in Table 16 for the period 1951-1966 for both groups of counties and, as well, for the remaining 26 counties of Southern Ontario.

The percentage loss of improved land and of unimproved land can be expected to be related to the percentage of total farmland loss. In fact, if loss under the first two categories is exactly in proportion

TABLE 16

Percentage Loss of Census Farmland by Broad Use Categories: Selected Counties of Southern Ontario, 1951-1966

County	Percentage Loss		
	Total Farmland	Improved Land	Unimproved Land
"Extensive" Counties			
Parry Sound	43.3	23.5	48.9
Muskoka	44.7	31.0	49.4
Victoria	9.4	7.0	11.9
Haliburton	47.9	45.0	48.8
Peterborough	16.7	11.4	21.7
Hastings	21.3	16.9	24.3
Lennox & Add.	16.8	11.4	21.6
Frontenac	30.8	8.1	42.1
Renfrew	20.9	10.1	27.1
Lanark	12.5	3.4	17.0
Leeds	11.2	7.1	14.4
GROUP	21.4	11.2	27.7
"Urban" Counties			
Welland	20.6	15.4	39.2
Lincoln	10.0	9.5	12.5
Wentworth	22.5	18.0	37.5
Halton	25.1	21.0	37.6
Peel	21.5	19.0	30.7
York	27.4	23.1	40.9
Ontario	16.5	12.0	25.0
Carleton	20.8	15.4	30.7
GROUP	20.9	16.9	31.7
"Remaining" Counties			
(26 counties)	6.7	0.6	23.7

to their contribution to total farmland in a county in 1951, then percent losses across any line of the table will be equal.

Every entry in the "unimproved land" column exceeds the corresponding entry in the "improved land" column for both groups of counties. In four cases, however, the difference is relatively minor. Especially for the "extensive" group, retirement of farms that had been allowed to "run down" since 1951 (a "golden" year for Canadian agriculture) alone could explain higher percentages in the last column of the table. Furthermore, it is natural to expect some bias in whole-farm retirement toward farms with unimproved land a higher proportion than average.

More important is the fact that for each group the three columns are much less dissimilar than is the case for the remaining 26 counties taken together. Each group has experienced a rate of farmland loss that was more than three times that for the rest of Southern Ontario, and at the same time has lost improved farmland in a proportion that is dramatically less dissimilar to that applying to their agricultural estates in 1951. There is thus strong supporting evidence for both hypotheses.

In Summary

A significant distinguishing feature of regions within the agricultural estate of Southern Ontario is possibly the different degree to which farmland can be the subject of "improvement". Our analysis suggests the association of a high level of improvement with better profit conditions and with a resistance to sell "improved" parcels of land except where urban pressures are consolidated and

large-scale. In these circumstances the mechanism of retirement is by means of whole-farm sales. The same mechanism operates in regions which are poorly endowed with resources essential to agriculture. The transfer in these regions is, however, probably largely due to land speculation and to recreational, and not to direct urban uses.

Where neither urban-expansion nor recreational demands are significant, improved farmland is securely held, and "losses" comprise predominantly portions of farms that are agriculturally undeveloped.

RATES OF CHANGE IN IMPROVED AND UNIMPROVED FARMLAND

In order to better understand the origin and strength of factors impacting the use of land by agriculture in Southern Ontario, an examination of the change over time in the acreage of improved and unimproved land in census farms was undertaken. Data on change over the 5-year periods 1951-1956 and 1961-1966, and also over the 15 years 1951 to 1966 were assembled and expressed as percentages of the acreages of the appropriate earlier date of measurement[1]. The analysis was done at the level of the township, for the 42 counties of any agricultural significance in Southern Ontario[2]. This section describes the findings of this analysis of historic change in the two major categories of land use on census farms.

Classes of percentage change were devised so as to take account of the direction and magnitude of change in each of the three time spans. The greatest weight for classification purposes was given, however, to the longest period, 1951-1966 -- as the set of rules given further below will indicate. For all time periods the same five categories of change (expressed as a range of percentages) were employed. Commencing from the category representing greatest percentage decreases, these were:

--greater than 15% decrease (>-15)

--decrease from 15% to 6% (-15 to -6)

--from decrease of 5% to increase of 4% (-5 to 4)

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[1]Percentage change for the period 1956-1961 was not calculated because of the change made in the definition of a census farm in 1961. A discussion of the effects of this definitional change is given in Appendix I.

[2]These counties are also the more populous counties of Southern Ontario.

--increase from 5% to 14% (5 to 14)

--increase of 15% and more (15-and-more)

The change classes and the set of rules upon which they were based are as follows:[1]

S = all three rates in the range -5 to 4

DM(IM) = 1951-1966 rate in the range -15 to -6 (5 to 14); other rates generally negative or weakly positive (positive or weakly negative) and one in the range >-15 (15-and-more) is acceptable

DL(IL) = 1951-1966 rate in the range >-15 (15-and-more), but not numerically greater than -50% (+50%); other rates as for DM(IM) and never in the opposing category 15-and-more (>-15)

DLL(ILL) = as for DL(IL), but 1951-1966 rate numerically greater than -50% (+50%)

S- = 1951-1966 rate in the range -5 to 4; and either the 1951-1956 rate or the 1961-1966 rate, or both, in the category -15 to -6 or 5 to 14, and neither in the category >-15 or 15-and-more

U- = 1951-1966 rate in the range -5 to 4; other two rates not definitely both positive or both negative and at least one in the range >-15 or 15-and-more

UD-(UI-) = 1951-1966 rate in the range -15 to -6 (5 to 14); and at least one of the other rates in an opposing category 5 to 14 or 15-and-more (-15 to -6 or >-15) provided further that one is in the category >-15 or 15-and-more

UD(UI) = 1951-1966 rate in the range >-15 (15-and-more), but otherwise as for UD-(UI-)

The classification as described in effect recognizes the existence and provides some measure of:

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[1] AUTHOR'S NOTE: It is recognized that the above set of rules is not completely satisfactory because all theoretical possibilities are not exhausted. Not exactly in the best traditions of the scientific method, the final version of the rules was written after the intentions and spirit of the classification system had been satisfied. The latter operation proved to be less difficult than the former. Despite some deficiencies in describing the rules that were applied, the reader may be assured that the classification outcome is one of strict impartiality. An explanation of the symbols follows: S = stable; U = unstable; D = decrease; I = increase; M = moderate; L = large; LL = very large; - implies "fairly".

1. constancy or instability in the direction of change over time
2. the magnitude of unidirectional change, whether positive or negative
3. the magnitude of bidirectional change

Re(1): Class S represents one extreme, and Class UD(UI) represents the other, of variability in the direction of change.

Re(2): The extremes for classes indicating size of unidirectional change are S and DLL(ILL).

Re(3): The Classes UD-(UI-) and UD(UI) represent two magnitudes of bidirectional change, each based on percentage change over the full period 1951-1966. Classes S- and U-, on the other hand, do not necessarily indicate bidirectional change. Rather they reflect percentage change over one or both shorter time spans that increased between S- and U-. These changes (and the change between 1956 and 1961 which was not considered) are, however, off-setting in both cases with respect to the longer period, 1951-1966.

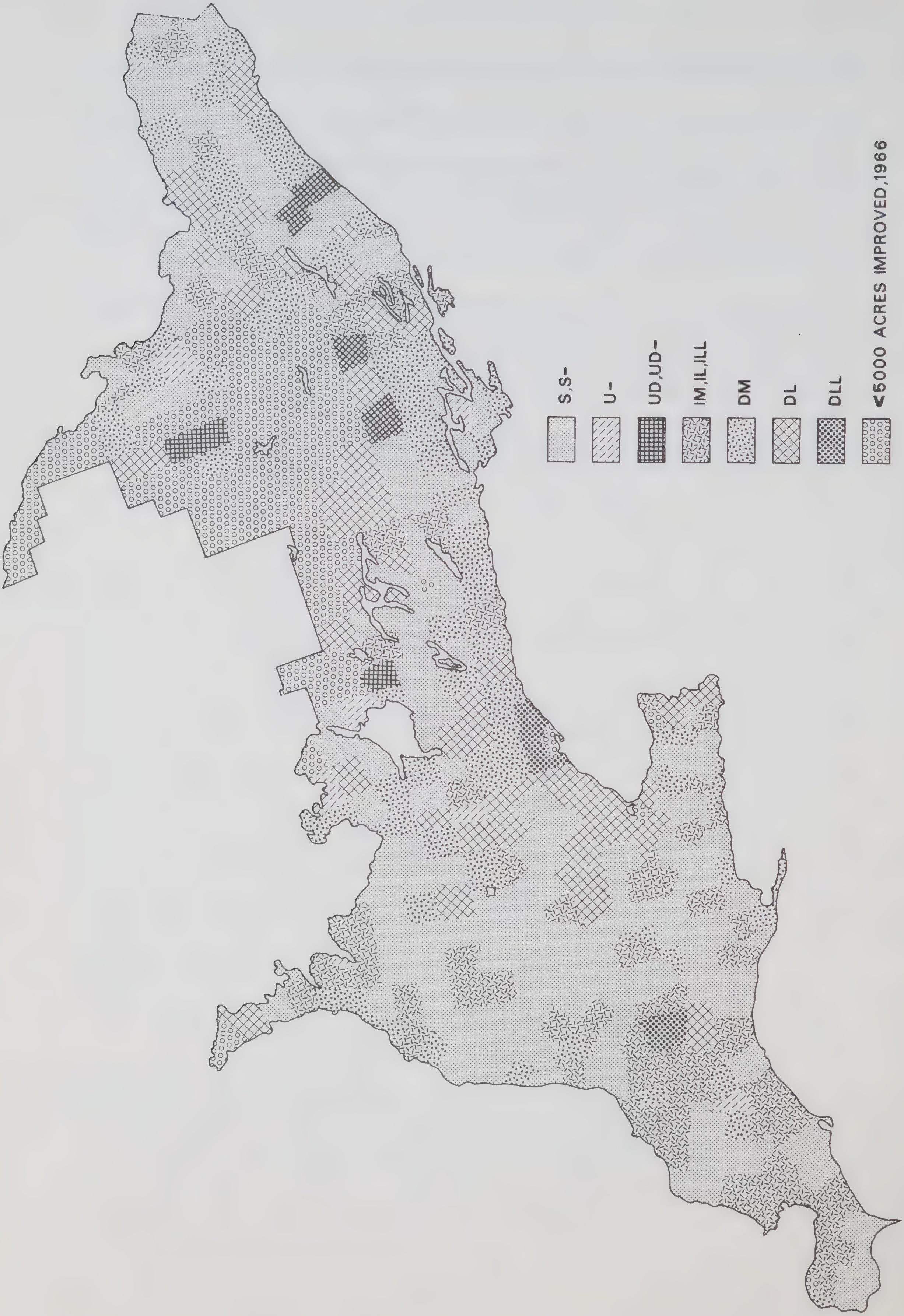
Data for Improved Farmland

The initial mapping of the 13 change classes described above was somewhat unsatisfactory on a grain as fine as the township unit. The number of classes was subsequently reduced to nine, through the combination of Classes S and S-, Classes IM, IL and ILL, and Classes UD and UD-. What was considered to be an unwarranted emphasis toward a large reduction in improved land supplied by a compact block of townships on the Precambrian Shield was then removed by discarding townships reporting less than 5,000 acres of improved land on census farms in 1966. This elimination effectively removed an additional two change classes, leaving a residual of seven.

Figure 10 is the map of the change classes that remained. Highlights that emerge from the classification system employed are:

1. The greatest concentration of townships that experienced least change in acreage of improved land over all time periods is found in the Midwestern Ontario Economic Region.

2. Lesser concentrations of these "stable" townships are found in the Georgian Bay Region (except the Bruce Peninsula); in the Lake Erie Region generally east of London; along the "spine" and into the eastern extremity of the Eastern Ontario Region; and in three somewhat distinct parts of the St. Clair Region.
3. A lens of stability runs east from Lake Simcoe roughly paralleling the southern edge of the Precambrian Shield and terminating in Prince Edward Co.
4. Any concentration of townships that experienced increases in improved land is found in several pockets in the St. Clair Region, extending east into the western part of the Lake Erie Region.
5. Elsewhere, the occurrence of increases tends to be fairly sporadic with only minor concentration in the Georgian Bay Region.
6. The pattern of decrease in improved farm acreage (at the township level) is coincident with the pattern of major urban centres in Southern Ontario. Coincidence is particularly strong along the rapidly urbanizing lake fringe, from Cobourg in the east around to Niagara Falls in the south, and extending west from Metropolitan Toronto to incorporate the "Golden Triangle" of Kitchener-Waterloo, Guelph and Galt, and the hinterland of Hamilton. Townships adjacent to London, Ottawa, and Kingston also exhibit relatively large percentage decreases in improved land.
7. Generally speaking, townships east of Trenton that front Lake Ontario and the St. Lawrence River experienced fairly regular losses of improved land over the period 1951-1966.



CLASSES OF CHANGE IN IMPROVED FARMLAND 1951–1966

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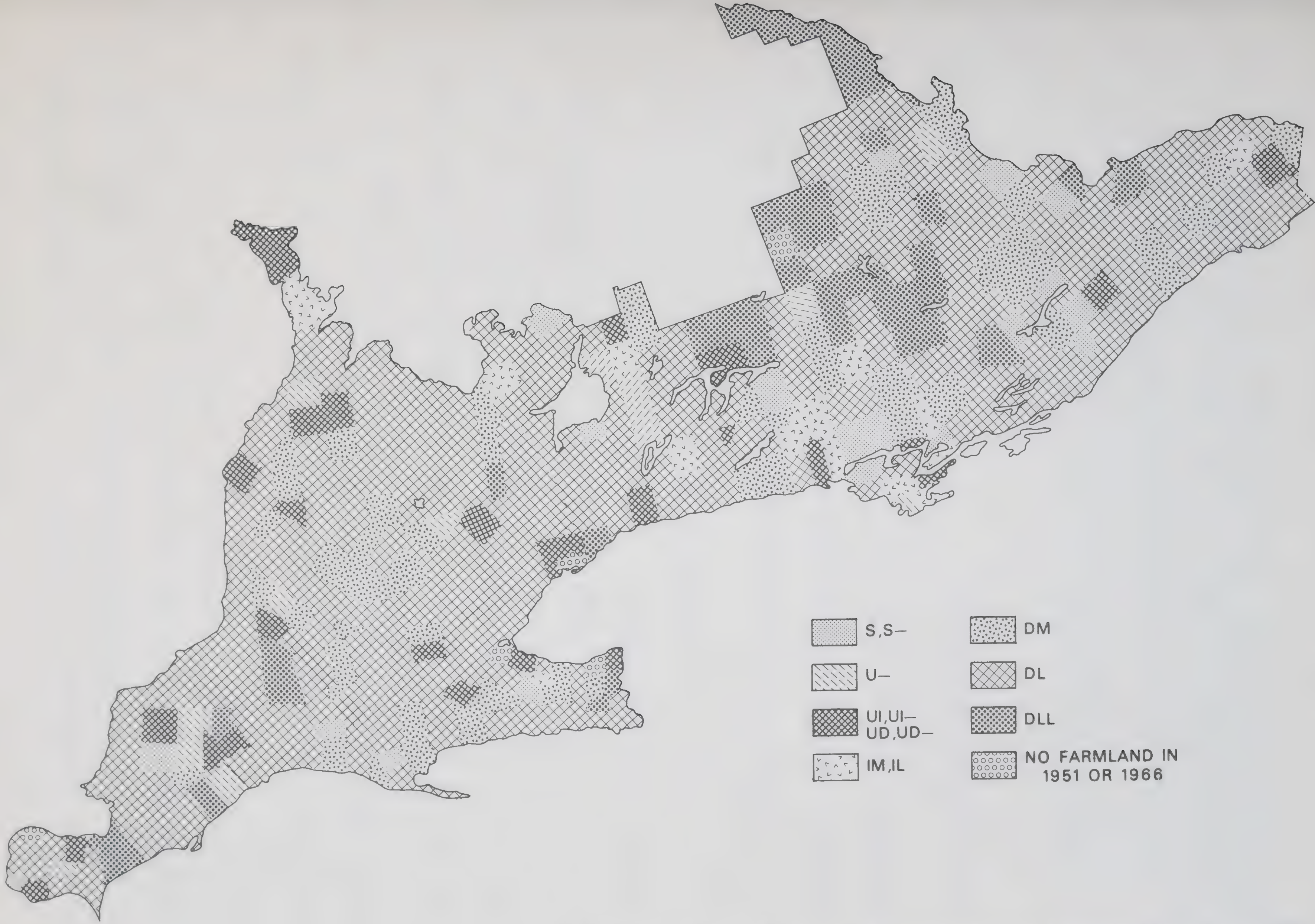

CLASSES OF CHANGE IN UNIMPROVED FARMLAND 1951-1966

11

8. A third pattern of loss can be discerned as an extension northward of urban Toronto influences into the eastern third of the Georgian Bay Region and as a southerly and easterly fringe to the Precambrian Shield. Decreases here are interpreted as being associated largely with land speculation but also with recreational developments.

Data for Unimproved Farmland

The mapping of classes of change in unimproved farmland proceeded on much the same basis as that for improved land. There was, however, a somewhat different consolidation of the original change classes in order to reduce to more manageable dimensions the number of classes that was mapped.

Figure 11 is a record of the seven change classes that remained after consolidation.

The outstanding feature of Figure 11 is the pervasiveness of large and very large percent decreases (DL and DLL) in unimproved farmland. Nearly 80 percent of the townships are caught if these two classes are combined with DM, the class of moderate decrease. The concentration of very large percent decreases (DLL) that can be observed among the Shield townships considered is even more significant when the higher percentage of unimproved land there than elsewhere in 1951 is taken into account.

A comparison of largely unconsolidated change-class data indicated that in a number of townships large or very large percentage increases in improved farmland were associated with a corresponding large or very large decreases in unimproved land. For example, the only three

townships of southwestern Ontario that showed such increases in improved land were all so placed. In the circumstances a conversion of unimproved to improved land might reasonably be presumed.

PROJECTED LOSSES OF FARMLAND TO URBAN USES

Urban Development Uses of Land

A late 1960 study by the Research and Special Studies Section of the Community Planning Branch, Ontario D.M.A., provided data useful for estimating likely future losses of farmland in Southern Ontario due to transfer from agricultural to urban use[1]. The study examined the quantities of land devoted to different uses in a fairly representative sample of 52 urban municipalities ranging in population size from 700 to over 1,650,000 people. Research indicated a high correlation coefficient (r = 0.99) when the logarithm of total developed acreages within municipal boundaries was regressed on the logarithm of the corresponding populations. That is to say, the relationship between the area developed for urban purposes and population was found to be exponential. It was calculated to be:

$$y = (x^{.856})/2.223$$

where y is total developed area in acres

x is population

The "total developed area" included the following land uses:

--residential

--commercial

--industrial

--institutional

--parks and public open space

Adjacent streets were included when acreages were measured. Vacant and agricultural land, however, was excluded. All measurement was made

[1]Department of Municipal Affairs, "Urban Land Use in Ontario: Areas and Intensities".

within statutory municipal boundaries.

Population projections by the Economic Analysis Branch, Economic and Statistical Services Division, Ontario Department of Treasury and Economics, provided the second data series upon which calculations of future farmlands loss were based[1]. These projections made use of three different assumptions for Ontario both as to the change in total fertility rates (A, B and C[2]), and as to annual net migration (30,000, 50,000 and 70,000). Of the nine combinations possible, the central assumption (B - 50,000) was employed for the most part in our calculations.

Estimated future urban land uses were obtained by plugging population values into the regression equation and reading acreages directly. Initially, estimates of total developed areas in each of the years 1971, 1976, 1981, 1986 and 1991 for each of the 6 Census Metropolitan Areas (C.M.A.) and the 12 Major Urban Centres (M.U.C.) of Southern Ontario were obtained, using the central assumption B - 50,000 --Table 17. It will be noted from the tables that the percentage of Southern Ontario's population accounted for rises from 72.5% in 1971 to 78.2% in 1991.

To check the sensitivity of the analysis to variable "population" assumptions, total developed areas in 1991 were estimated for the same set of urban municipalities, using "extreme" assumptions

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[1]The following were used:
(1) "Ontario: Population Projections for Counties and Districts, 1966-2001", March 1970.
(2) "Ontario Population Projections 1966-2001: Municipal Projections", May to September 1970.

[2]Assumption A: Total fertility rate will decline from 2787 in 1966 to 1397 in 1991.
B: Total fertility rate will decline from 2787 in 1966 to 2156 in 1971, and then remain constant till 1991.
C: Total fertility rate will remain unchanged at the 2700 level during the period 1966-1991.

TABLE 17

Estimates of Developed Urban Areas[1], Selected Urban Municipalities of Southern Ontario: 1971, 1976, 1981, 1986, 1991
(Population Projection: B-50,000)

Economic Region	Urban Municipality	Developed Urban Area[1] 1971	1976	1981	1986	1991
		(000 acres)				
St. Clair						
	Windsor[2]	17.62	18.97	20.51	22.13	23.71
	Chatham[3]	3.67	4.08	4.54	5.02	5.51
	Sarnia[3]	6.67	7.26	7.94	8.65	9.33
Lake Erie						
	London[2]	17.54	18.97	20.51	22.13	23.71
Niagara						
	Hamilton[2]	33.57	36.73	40.18	43.95	47.64
	Brantford[3]	6.08	6.47	6.88	7.35	7.78
	Niagara Falls[3]	6.17	6.73	7.35	8.00	8.63
	St. Catharines[3]	10.03	11.25	12.33	13.46	14.62
	Welland	6.03	6.59	7.21	7.85	8.49
Midwestern Ontario						
	Kitchener[2]	16.60	18.20	19.36	21.63	23.39
	Guelph[3]	5.28	5.70	6.18	6.67	7.16
Central Ontario						
	Toronto C.M.A.[2]	141.62	156.19	169.11	184.04	199.18
	Brampton[3]	5.56	6.81	8.20	9.73	11.30
	Oshawa[3]	10.30	12.05	13.96	16.00	18.11
Lake Ontario						
	Belleville[3]	3.56	3.84	4.13	4.44	4.73
	Peterborough[3]	5.57	5.90	6.27	6.67	7.03
Eastern Ontario						
	Ottawa[2]	29.80	32.28	35.08	37.93	40.74
	Kingston[3]	7.03	7.59	8.17	8.77	9.35
	TOTAL	332.70	365.61	397.91	434.42	468.41
Relatives (1971 = 100.0)		100.0	109.9	119.6	130.6	140.8
Percent. of proj. pop.[4]		72.5	74.2	75.6	76.9	78.2

[1]Excludes vacant and agricultural land
[2]Census Metropolitan Area (C.M.A.)
[3]Major Urban Centre (M.U.C.)
[4]Of the 42 most populous counties of Southern Ontario

A - 30,000 and C - 70,000--Table 18. Because A - 30,000 and C - 70,000 projections were not available by urban municipalities (but only on a county basis) it was assumed for each urban municipality in 1991 that:

$$\text{urban}_{A-30,000} = \text{urban}_{B-50,000} \times \text{county}_{A-30,000} / \text{county}_{B-50,000}$$

and

$$\text{urban}_{C-70,000} = \text{urban}_{B-50,000} \times \text{county}_{C-70,000} / \text{county}_{B-50,000}$$

Developed urban land for the total urban population (of the 42 most populous counties of Southern Ontario) in 1991 was also calculated. For this computation it was assumed (1) that the nonurban population in 1991 remained at the 1966 level over-all projection assumptions--that is, that the decline in farm population was matched by the increase in rural nonfarm residents, and (2) that the urban population not included in the 18 selected urban municipalities always resided in towns each of 10,000 people regardless of the particular assumption with respect to projected populations. Neither (1) nor (2) is likely to distort developed urban land estimates to any great extent. The estimated increases in developed urban areas during the period 1971-1991, both in absolute terms and relative to various bases, are given in Table 19 for projection assumptions A - 30,000 (low), C - 70,000 (high) and B - 50,000 (centre). The assumption of nonurban populations steady at the 1966 level is partly responsible for the range of percentages calculated for Item 1 (C). Under Item (3) it will be noticed that even for the high population projection, developed urban areas are not estimated to exceed 3 percent of the total land area of Southern Ontario (42 countries) by 1991. For the central population projection, the increase in developed urban areas for the 20 years 1971-1991 calculates to approximately 42 percent of 1971 urban developed acreage--

TABLE 18

Estimates of Developed Urban Areas[1], Selected Urban Municipalities of Southern Ontario, Using Different Population Projection Assumptions: 1991

Economic Region	Urban Municipality	Developed Urban Area[1] Projection Assumption A-30,000	C-70,000	B-50,000
		(000 acres)		
St. Clair				
	Windsor	21.93	27.73	23.71
	Chatham	5.14	6.21	5.51
	Sarnia	8.67	10.59	9.33
Lake Erie				
	London	21.83	26.24	23.71
Niagara				
	Hamilton	42.66	56.23	47.64
	Brantford	7.19	8.97	7.78
	Niagara Falls	7.83	10.00	8.63
	St. Catharines	13.40	16.71	14.62
	Welland	7.73	9.84	8.49
Midwestern Ontario				
	Kitchener	21.68	26.92	23.39
	Guelph	6.59	8.20	7.16
Central Ontario				
	Toronto C.M.A.	177.37	229.35	199.18
	Brampton	10.47	14.36	11.30
	Oshawa	16.83	22.54	18.11
Lake Ontario				
	Belleville	4.40	5.26	4.73
	Peterborough	6.67	7.64	7.03
Eastern Ontario				
	Ottawa	38.02	44.06	40.74
	Kingston	8.71	10.33	9.35
	TOTAL	427.12	541.18	470.41
Relatives (B-50,000 = 100)		90.8	115.0	100.0
Percent. of proj. pop.[2]		77.5	76.0	78.2

[1]Excludes vacant and agricultural land

[2]Of the 42 most populous counties of Southern Ontario

TABLE 19

Estimates of Developed Urban Areas[1], Southern Ontario, Using Different Population Projection Assumptions: 1991

Item	Unit	Population Projection Assumption		
		A-30,000	C-70,000	B-50,000
1. Projected populations:				
a. All C.M.A.s and M.U.C.s	000	6,473	8,578	7,280
b. All urban areas[2]	000	7,241	10,179	8,207
c. Item 1 (b) as percent of total population[2]	%	86.7	90.2	88.1
2. Developed urban areas:				
a. All C.M.A.s and M.U.C.s	000 acs.	427.12	541.18	470.41
b. All urban areas[2]	000 acs.	518.82	732.34	581.09
3. Item 2 (b) as percent. of total land area[2]				
a. All urban areas[2]	%	2.12	2.99	2.37
4. Increase in developed urban areas, 1971-1991				
a. All C.M.A.s and M.U.C.s	000 acs.	94.42	208.48	137.71
b. All urban areas[2]	000 acs.	109.66	323.18	171.93
5. Item 4 (b) as percent of land in farms, 1966 Census				
a. All urban areas[2]	%	0.69	2.04	1.08
6. Increase during 1971-1991 as percent. of developed urban area, 1971				
a. All C.M.A.s and M.U.C.s	%	28.4	62.7	41.4
b. All urban areas[2]	%	26.8	79.0	42.0

[1]Excludes vacant and agricultural land

[2]Of the 42 most populous counties of Southern Ontario

Item 6 (b). The corresponding absolute increase of some 172,000 acres represents 1.08 percent of the total land in census farms in Southern Ontario (42 counties) in 1966. It is only approximately 37 percent of the land in census farms that was under crops in 1966 in Kent Co. (but more than double the 1966 total of improved land in census farms in Welland Co.). (It is also only 4 times the estimated land requirements for the proposed new Pickering Airport, if its associated urban development is included).

It is hardly necessary to point out that these findings, of course, are subject to the accuracy of the assumptions underlying them. The future rate of population growth in Southern Ontario is obviously of crucial importance in assessing the extent to which farmland might be retired to urban development in the decades ahead. The distribution of the increase between urban and rural areas is not as important, although overestimation of the degree of "urbanization" will likely result in underestimation of farmland retrenchment.

Two additional points should be noted. The first is that the calculations given in Tables 17 to 19 are based on areas of urban development within municipal boundaries. If measurement had included urban fringe development, areas estimated would likely have been slightly higher. The second point concerns the possibility of changes in urban-development intensity over time. We have assumed a stable area-population relationship. Evidence could be presented in support of various shifts in the regression line described at the outset. On balance, however, a slight swing to the right might represent the most probable trend. Such a shift would reduce urban development areas below those calculated and presented here.

Idle Land within Municipal Boundaries

The opinion is often expressed that the significance to agriculture of the expansion of towns and cities into their surrounding farmland is manifested in the idling of the productive process rather than the extent to which land use undergoes positive change. For example, Crosswhite and Vaughan reported in 1962 that idle land accounted for 28% of all land in a Delaware (U.S.A.) county[1]. In another United States study, Allee suggested in 1966 that of the some 200,000 acres of land passing out of farming per year in New York State, "perhaps 15,000 acres per year go into true urban uses, with at least another 15,000 idled because they are interspersed with lands being occupied by urban uses"[2].

In this section we examine the idling process to the extent that it occurs within municipal boundaries. This is done by making the assumption, admittedly grossly simplifying, that land within municipal boundaries that is not already developed for urban purposes is effectively withdrawn from agriculture. Developed and undeveloped areas are compared for two sets of municipalities. The first comprises "greater" municipalities--the complete set of 18 Census Metropolitan Areas and Major Urban Centres that exist at present in Southern Ontario. Their 1966 populations ranged from about 31,500 to 1,825,000. The second is a group of "lesser" municipalities with populations from about 10,500 to 24,500 in 1966.

<u>The "greater" municipalities</u>: Developed urban areas in 1966 were estimated to amount in aggregate to 243,790 acres or 55.9% of the total land area

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[1] W. M. Crosswhite and G. F. Vaughan, "Land Use in the Rural-Urban Fringe", Delaware Agr. Exp. Sta. and Div. of Urban Affairs, Bul. 340, July 1962.

[2] David J. Allee, "Changing Use of Rural Resources", Journal of Farm Economics, 48:1966, pp. 1297-1305.

of 435,920 acres within urban municipality boundaries at the time--Table 20. The difference of 192,130 acres of potentially (urban) developable land represents 44.1% of the total land area of these "greater" municipalities. The percentage of area developed ranges from lows of 20.5% for Niagara Falls and 27.8% for Guelph to highs of 78.0% for Ottawa and 96.1% for Toronto City[1].

The "lesser" municipalities: For these 9 cities and towns combined, the developed urban area of some 17,080 acres represents 43.2% of their total municipal areas--Table 21. The corresponding data for areas not urban developed are 22,470 acres and 56.8%. None of the 9 showed developed urban areas greater than about 56% of total area. Dispersion about the mean (43.2%) was much less than in the case of the "greater" municipalities. The generally lower percentage of developed urban area for the "lesser" municipalities might partly be explained by a greater tendency toward the well-known phenomenon of "leap frogging". The prospect of easier land assembly and better land "buys" at the fringe could stimulate this process in the case of smaller towns surrounded by active farming. Further research in this area is possibly warranted.

If 80% of the total urban area is regarded as a reasonable upper limit to urban development, it is easily calculated that the 27 municipalities selected as a sample for examination here themselves contained in 1966 a reserve of 119,500 acres of potentially developable land. This is approximately 70% of the increase calculated in the section above for all urban areas over the period 1971-1991, based on

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[1]The low percentages for Niagara Falls and Guelph are explained in the main by major annexations that had occurred just prior to 1966. The high for Ottawa follows concentration inside its confining greenbelt.

TABLE 20

Urban Development as a Percentage of the Area of
Selected "Greater" Urban Municipalities, Southern Ontario, 1966

Municipality	Population	Urban Development	Area of Municipality	Col. 2 as % of Col. 3
	1	2	3	4
		(000 acres)		
Metropolitan Toronto	1,825,099	103.00	154.65[a]	66.6
Toronto City	678,729	21.50[b]	22.37	96.1
Ottawa	288,377	21.23	27.22	78.0
Hamilton	283,345	20.89	30.35	68.8
London	187,624	14.69	38.35	38.3
Windsor	187,418	14.66	29.59	49.5
Kitchener-Waterloo	121,146	10.09	19.35	52.1
St. Catherines	95,303	8.22	16.38	50.2
Oshawa	77,126	6.86	13.61	50.4
Brantford	58,395	5.41	11.23	48.2
Niagara Falls	54,340	5.08	24.73	20.5
Kingston	54,086	5.07	7.12	71.2
Peterborough	54,064	5.07	12.97	39.1
Sarnia	53,260	5.00	8.10	61.7
Guelph	49,497	4.70	16.88	27.8
Welland	39,014	3.83	8.72	43.9
Brampton	34,936	3.48	5.41	64.3
Belleville	32,954	3.32	5.94	55.9
Chatham	31,479	3.19	5.32	60.0
TOTAL[c]	3,527,463	243.79	435.92	55.9

[a]1971 data

[b]Actually measured in 1963, not calculated from regression equation

[c]Excludes Toronto City which is included within Metropolitan Toronto

Sources: Col. 1 - Ontario Department of Municipal Affairs, 1967 Municipal Directory

Col. 2 - Estimated from regression line: D.M.A., Urban Land Use in Ontario: Areas and Intensities

Col. 3 - Geography Section, Census Division of Statistics Canada, Mimeo

TABLE 21

Urban Development as a Percentage of the Area of Selected "Lesser" Urban Municipalities, Southern Ontario, 1966

Municipality	Population	Urban Development	Area of Municipality	Col. 2 as % of Col. 3
	1	2	3	4
		(000 acres)		
Barrie	24,417	2.56	6.34	40.4
Woodstock	23,828	2.51	5.42	46.3
Stratford	22,791	2.42	5.02	48.2
Owen Sound	18,074	1.98	3.52	56.3
Port Colborne	17,831	1.96	5.22	37.5
Whitby	15,061	1.69	4.28	39.5
Lindsay	11,763	1.37	3.78	36.2
Georgetown	11,658	1.36	3.08	44.2
Cobourg	10,386	1.23	2.89	42.6
TOTAL	155,809	17.08	39.55	43.2

Sources: Col. 1 - Ontario Department of Municipal Affairs, <u>1967 Municipal Directory</u>

Col. 2 - Estimated from regression line: D.M.A., <u>Urban Land Use in Ontario: Areas and Intensities</u>

Col. 3 - Geography Section, Census Division of Statistics Canada, Mimeo

the central population projection -- B-50,000[1]. On the other hand, if the 1966 ratio of about 0.8 to 1.0 between undeveloped and developed urban areas within municipal boundaries suggested by our sample of 27 cities and towns remains steady (through progressive annexation), an additional retirement of farmland equal to about 137,500 acres over the period 1971-1991 is indicated, using the same central projection assumption as before. That is to say, the total retrenchment of agricultural land up until 1991 (conceived as taking place within municipal boundaries expanding through annexation) adds to nearly 310,000 acres[2].

Urban Development Loss in Soil Capability Terms

This section examines the possible loss of better agricultural soils associated with the urban development projected by 1991 for the six Census Metropolitan Areas and twelve Major Urban Centres presently existing in Southern Ontario. The better agricultural soils are specifically Class 1 and 2 soils of the ARDA, Canada Land Inventory, Classification of Soil Capability for Agriculture.

The conversion of the urban development losses estimated in Section (b) above to losses of land of specified soil capability requires an assumption with respect to the areal distribution of capability classes. The assumption made here is that for an individual urban municipality, Class 1 and 2 soils will represent the same percentage of the land area effectively lost by reason of its urban expansion by 1991 as they are of the area of the township (or townships) adjacent to or "containing" it.

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[1]There is no implication, however, that the reserve was distributed in such a manner that the future urban-expansion needs of any municipality was always satisfied. The reserve exceeds by about 9% the increase calculated by using the low population projection--A-30,000.

[2]The corresponding figures for assumption A-30,000 are: additional retirement of 88,000 acres; total retrenchment of nearly 200,000 acres.

The following hypothetical case will serve as an illustration:

> The urban population in and around City C within Twp. T is projected to occupy and to idle an additional 10,000 acres of land by 1991. The percentage of T that is Class 1 and 2 soil is 40%. The loss of Class 1 and 2 soil by 1991 will, therefore, be 4,000 acres.

It might be argued that the assumption ignores the attraction of urban development to the better agricultural soils and, in consequence, will cause Class 1 and 2 soil losses to be underestimated. We do not dispute the potential for level, deep and well-drained agricultural soils to reduce the costs of building and the provision of urban services. Notwithstanding, the cost of site preparation is only one of many factors that influence land-use decisions. Moreover, objections to the use of the assumption are at least partially overcome by the fact that Class 1 and 2 soil percentages are applied here to total urban development areas--that is, to areas both directly accommodating urban uses but also those "idled" as a result of the urbanization process. Any preference that urban developers might have for the better agricultural soils thus has considerable scope for expression under the conditions of our analysis.

Details of projected Class 1 and 2 soil losses for each of the 18 "greater" urban municipalities previously considered are given in Table 22 for population projection B-50,000. Calculations of the total loss for the group of 148,600 acres by 1991 follows the assumption that undeveloped (that is, idled) urban areas will bear a constant relationship to developed areas by that time. This ratio is 0.79 to 1.0, derived from 1966 aggregate data previously presented in Table 20.

A loss of 148,600 acres for the "greater" municipalities represents a loss of about 1.5% of the total acreage of Class 1 and 2 soils in Southern Ontario. While not all areas of urban expansion are included in this analysis, some 78.2% of the projected population (both

TABLE 22

Losses of Class 1 and 2 Soils Due to Expanding Urban Influence, Selected Urban Municipalities of Southern Ontario, 1971-1991 (Population Projection B-50,000)

Economic Region	Urban Municipality	Increase in Urban Area[1] Developed 1	Increase in Urban Area[1] Total 2	Class 1 and 2 Soils Distribution[2] 3	Class 1 and 2 Soils Est. Loss 4
		(000 acs)		(%)	(000 acs)
St. Clair	Windsor	6.09	10.90	87.7	9.6
	Chatham	1.84	3.29	87.3	2.9
	Sarnia	2.66	4.76	31.4	1.5
Lake Erie	London	6.17	11.04	80.1	8.8
Niagara	Hamilton	14.07	25.19	54.5	13.7
	Brantford	1.70	3.04	60.6	1.8
	Niagara Falls	2.46	4.40	47.0	2.1
	St. Catharines	4.59	8.22	51.9	4.3
	Welland	2.46	4.40	49.0	2.2
Midwestern Ontario	Kitchener-Waterloo	6.79	12.15	51.0	6.2
	Guelph	1.88	3.37	48.8	1.6
Central Ontario	Toronto C.M.A.	57.56	102.97	68.4	70.4
	Brampton	5.74	10.27	71.9	7.4
	Oshawa	7.81	13.98	54.3	7.6
Lake Ontario	Belleville	1.17	2.09	31.4	0.7
	Peterborough	1.46	2.61	49.0	1.3
Eastern Ontario	Ottawa	10.94	19.58	28.6	5.6
	Kingston	2.32	4.15	21.0	0.9
	TOTAL	137.71	246.50	(60.28)[3]	148.6

[1]Includes areas idled but not actively developed. Col. 2 = Col. 1 x 1.79.

[2]Percentage of Class 1 and 2 soils in adjacent townships.

[3]Average, weighted by Col. 2 quantities.

TABLE 23

Losses of Class 1 and 2 Soils Due to Expanding Urban Influence, Under Three Population Projection Assumptions: Urban Areas of Southern Ontario, 1971-1991

	Population Projection Assumption		
	A-30,000	C-70,000	B-50,000
		(000 acres)	
Absolute Loss			
18 "greater" municipalities	100.6	227.5	148.6
all urban areas	121.8	386.8	196.1
Percentage Loss[1]		%	
18 "greater"municipalities	1.04	2.35	1.53
all urban areas	1.26	4.00	2.03

[1]Percent of total acreage of Class 1 and 2 soils in Southern Ontario - 9,680,304 acres.

urban and rural) of Southern Ontario in 1991 is being considered with use of the central population projection assumption (B-50,000) upon which urban development area increases are based.

It might be noted in conclusion that Class 1 and 2 soil losses during the period 1971-1991 can be estimated to decrease to some 100,600 acres under the low population projection assumption (A-30,000). At this level only about one percent of the total resource of these soils in Southern Ontario is likely to be involved. The corresponding figures for the high population projection (C-70,000) are 227,500 acres and 2.35%.

The above estimates relate to losses associated with the future expansion of the 18 "greater" urban municipalities that presently exist in Southern Ontario. Losses will increase when all urban areas are brought to account. No detailed estimation of these additional quantities were undertaken, but their approximate levels can be ascertained from the summary provided by Table 23.

It will be noted that the maximum percentage loss of Class 1 and 2 soils over the period 1971-1991 is estimated to be 4 percent of the total resource of this quality soil in Southern Ontario. This level probably represents a moderate overestimation of the loss attributable to the expansion of urban areas (but excluding loss reflected in increases in rural nonfarm residence). Overestimation under the C-70,000 population projection is likely on two counts:

- the percentage of the population living in rural areas will be higher than has been assumed
- urban residential densities will be greater than those implied here.

ALLOCATION OF LAND AMONG DIFFERENT USES

It is often thought that largely urbanised societies are making increasing demands on the rural landscape and that one of the major competitors with agriculture for the use of land is the urban society. This competition is manifest not only in the encroachment of cities on the countryside but also in the rise of hobby farms, non-agricultural occupancy of farmhouses, low density residential developments in the countryside, and the construction of recreational facilities. In this section this problem is examined in the context of studying the land resource actually used by agriculture. The loss of farmland as a result of urban demands which command higher levels of return per acre than agriculture is one of two major factors thought to influence the amount of land used by the industry. The second factor is the response to the marginal land base for farming in parts of Ontario. Both factors are conditioned by the cost/price differential prevailing at any one time, and given the current cost/price squeeze in agriculture in Ontario one would expect to find a significant loss of land from agriculture within the past ten to twenty years, as more jobs have been created in the cities and as the urban areas have grown in size to compete with agriculture on a scale never experienced before. The losses of total farmland, unimproved and improved acreages are shown in Figs. 12-14, and demonstrate that loss of land from farming is a widespread phenomenon in Southern Ontario.[1]

Since the actual area of land used by agriculture today results from responses in the agricultural system to inputs which, in some instances, pre-date this century, it is unrealistic to expect a satisfactory

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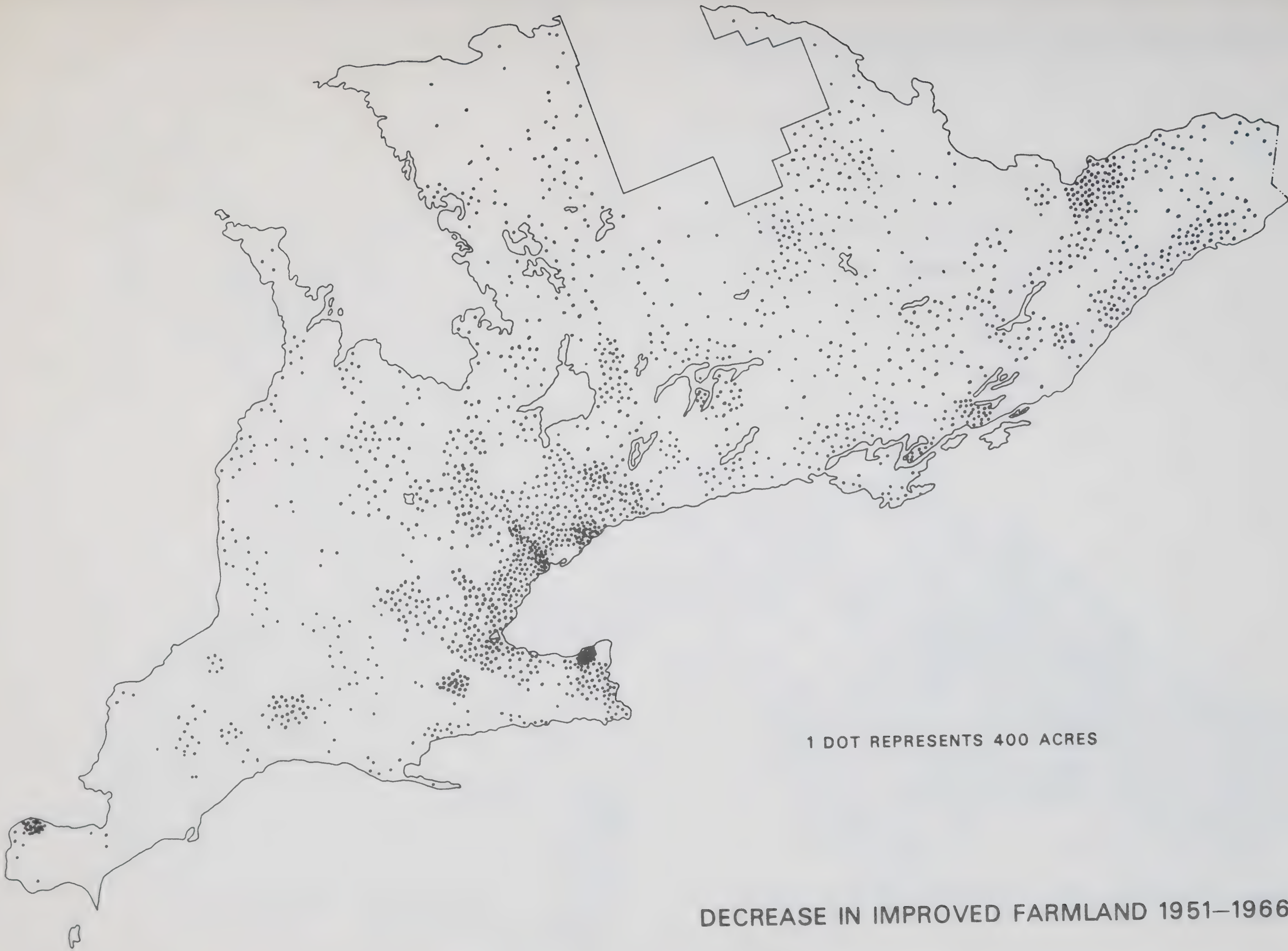
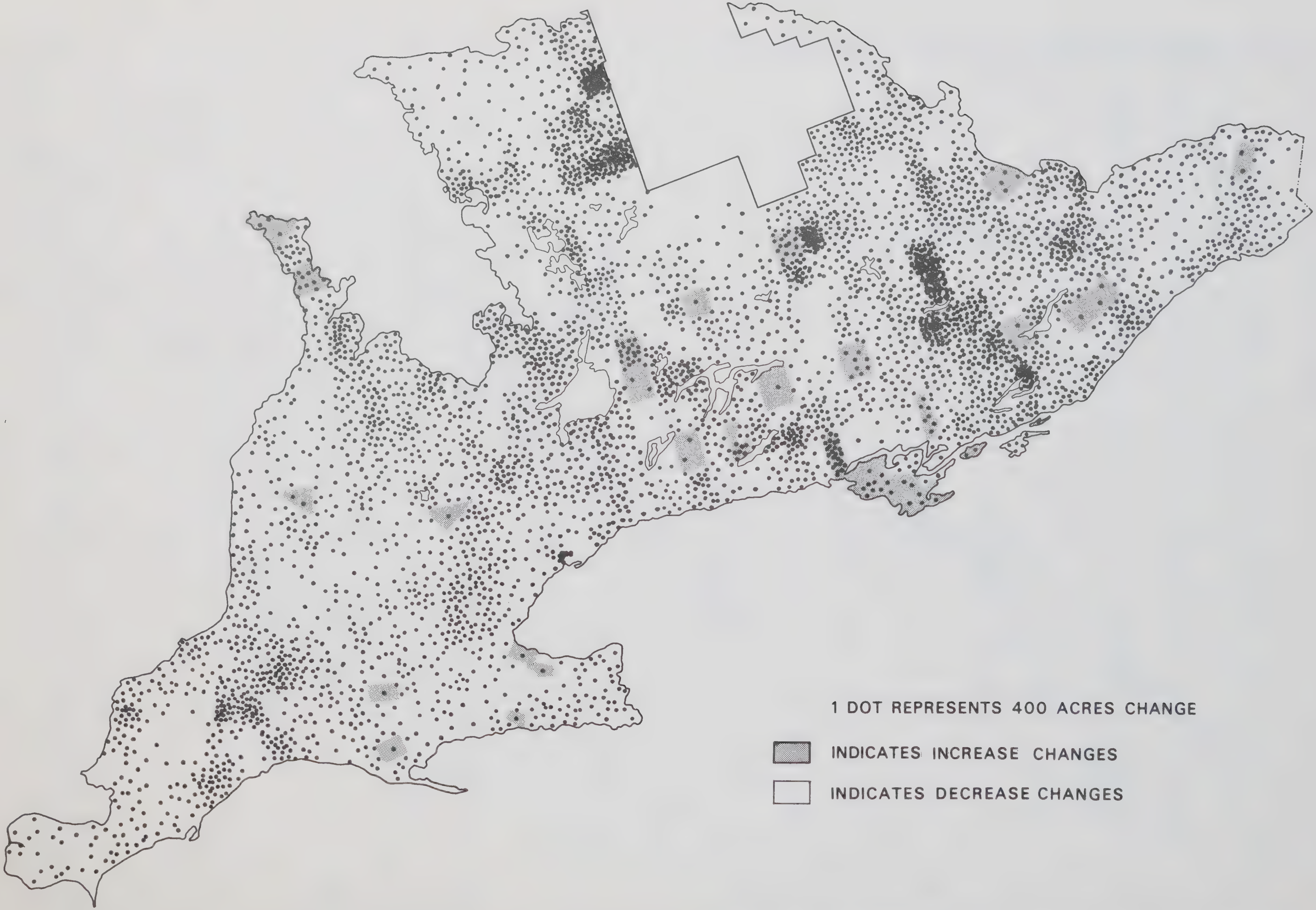
[1]Due to urban annexations of township land between 1951-1966, there is some visual distortion on the maps in the St. Catharines-Niagara, Windsor and Toronto areas.



DECREASE IN IMPROVED FARMLAND 1951–1966

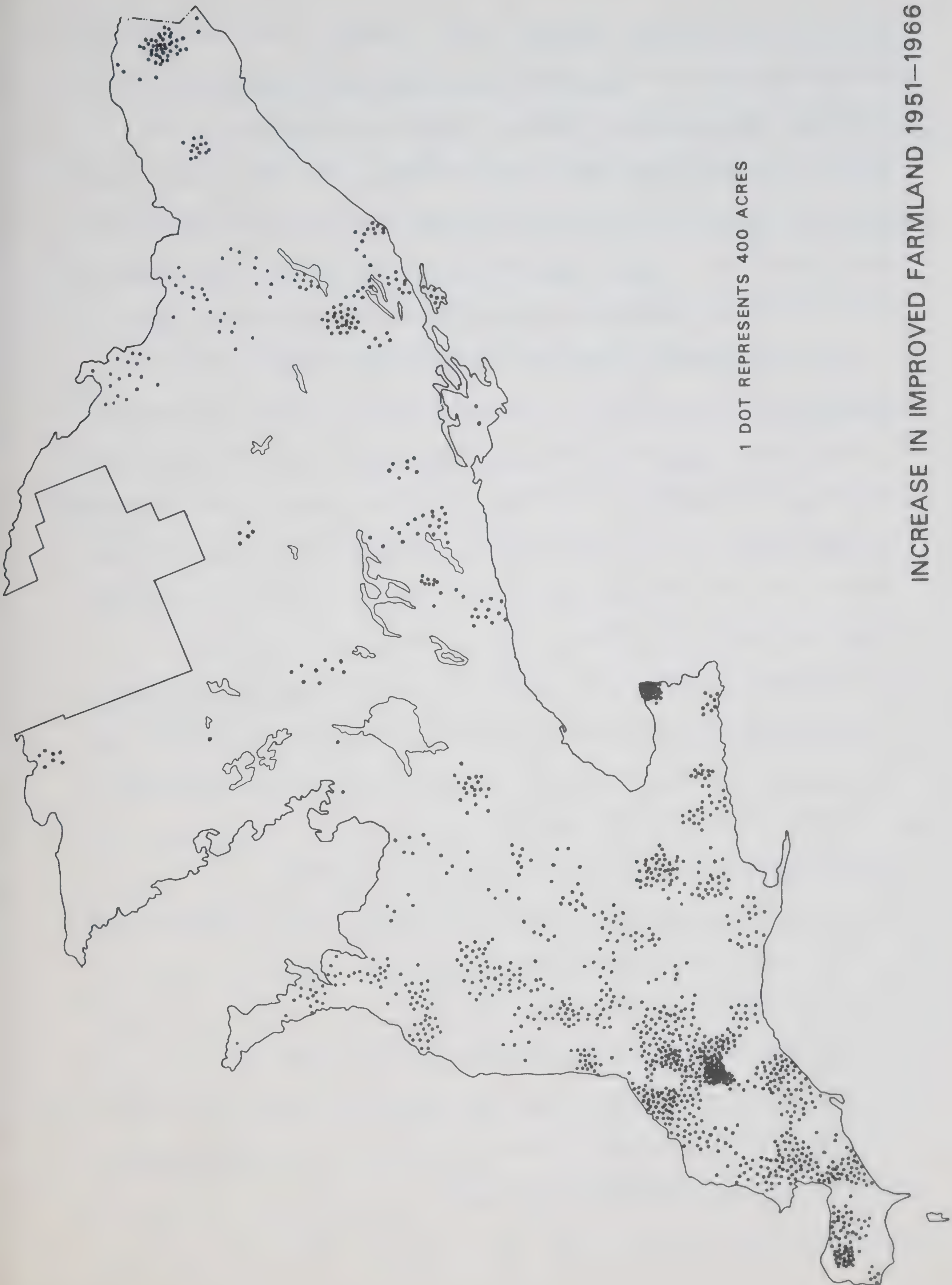
12



CHANGE IN UNIMPROVED FARM LAND 1951-1966

13

14



INCREASE IN IMPROVED FARMLAND 1951–1966

explanation of the area currently in use. However, the recent changes in the system can be more successfully studied since they result from influences which are more likely to be known and measurable. The problem of having to explain a static pattern is at least partly avoided if we can assume that the response to some input is independent of the state agriculture is in at any previous moments in time. This appears to be a reasonable assumption to make for the land allocation process.

The process whereby land is allocated in Southern Ontario between agriculture and other uses is extremely difficult to determine. A large number of factors could be involved and not all of them would operate across the whole of Ontario. Therefore, insight into the behaviour of these factors is required as well. The land allocation process was studied under the five headings listed below, following which a modest attempt to combine the effects found is made.

1. The amount of land likely to be taken from agriculture for municipal areas, and likely to become effectively part of the contiguous area of a city. Using an admittedly crude model, farmland losses for Ontario through to 1990 are given.
2. The spread of rural low density residences 1960-70.
3. Changes in the total area devoted to farming in the Toronto-Centred Region and in the Niagara Peninsula 1951-66.
4. The spread of recreational uses 1960-70.
5. The response to marginality 1951-66. It is assumed that losses of farmland not attributable to urban competition can be attributed to the effects of the cost/price squeeze coupled with the effects of the physical base for farming of a region.

1. The Loss of Land From Agriculture to Cities

Set alongside the overall area of Southern Ontario in agriculture in 1966, this area as estimated in the preceding section is relatively insignificant. Nor will it be highly concentrated, instead it is likely to be scattered through the province around cities.

2. The Spread of Rural Low Density Residences 1960-1970

The Ontario Hydro Electric Power Commission made available lists of rural hydro customers over most of the study area by township for a number of years. Here the changes in the density of various classes of customers between 1960 and 1970 are examined in order to estimate the extent of competition between agriculture and non-farming residential uses.

In 1960 1.4 million Ontario Hydro customers, who lived mainly in urban areas, and 1.9 million in 1970 were excluded from the data since they were served by other utilities, and the areas so affected were excluded from study in this section. The broad trends by township in four categories of rural customers defined by the Power Commissioners were studied. The groups are farm, high density rural residential, low density rural residential, and intermittent residential. The last category refers to seasonal customers and was utilised in assessing the impact of recreational functions on the countryside and will be discussed later. The remaining three categories will be defined and studied separately.

Under the classification scheme customers of Ontario Hydro are only considered to be farm operators when their holding is 30 acres or more and on which agricultural crops are grown. Special exceptions are made so as to include specialty farms, such as fruit, vegetable or poultry

farms, smaller than 30 acres, in this group. Other small domestic holdings whether or not they are used for agricultural production are classified as residential. This group showed little change in the density of customers per 100 acres of land between 1960 and 1970, for example, only 1 of the 71 townships with a density of less than 0.1 farm per 100 acres in 1960 had a greater density than this in 1970. Similarly, only 19 of the 141 townships having more than 0.7 farms per 1000 acres in 1960 had a lower density in 1970.

High density rural customers comprised all those year-round hydro customers living at a density of more than six customers per quarter mile road section. It, thus, includes those customers living in hamlets, villages and other built-up sections of the countryside. Between 1960 and 1970 the trend for these customers per 100 acres was if anything downward as the transition matrix given in Table 24 illustrates. This table shows the proportion of townships in a given density class in 1960 which were in each density class in 1970. The numbers may not add to 1.0 in this and similar tables because of rounding.

The tendency for a decline in density from 1960 to 1970 probably reflects the economic decline that has set in for many rural service centres in Ontario as in many other parts of Canada (see Hodge, G., Do Villages Grow?, Rural Sociology 31, 1966, p. 183-196) as well as a reclassification of customers following urban annexation. High density rural dwellers are not likely then to constitute a serious competition with agriculture for land in Southern Ontario. Their apparent decline probably is a reflection of a population movement out of farming and rural settlements in general, and is a symptom of the economic decline in agricultural

TABLE 24

Transition Matrix for Density of High Density
Rural Hydro Customers 1960-1970

Customers per 100 acres 1960		Customers per 100 acres 1970				
		<0.1	0.1-0.3	0.3-0.5	0.5-0.7	>0.7
	<0.1	0.95	0.04	0.0	0.0	0.01
	0.1-0.3	0.61	0.35	0.01	0.01	0.01
	0.3-0.5	0.28	0.34	0.22	0.13	0.02
	0.5-0.7	0.21	0.08	0.26	0.21	0.24
	>0.7	0.10	0.02	0.03	0.10	0.75

TABLE 25

Transition Matrix for Density of Low Density
Rural Hydro Customers 1960-1970

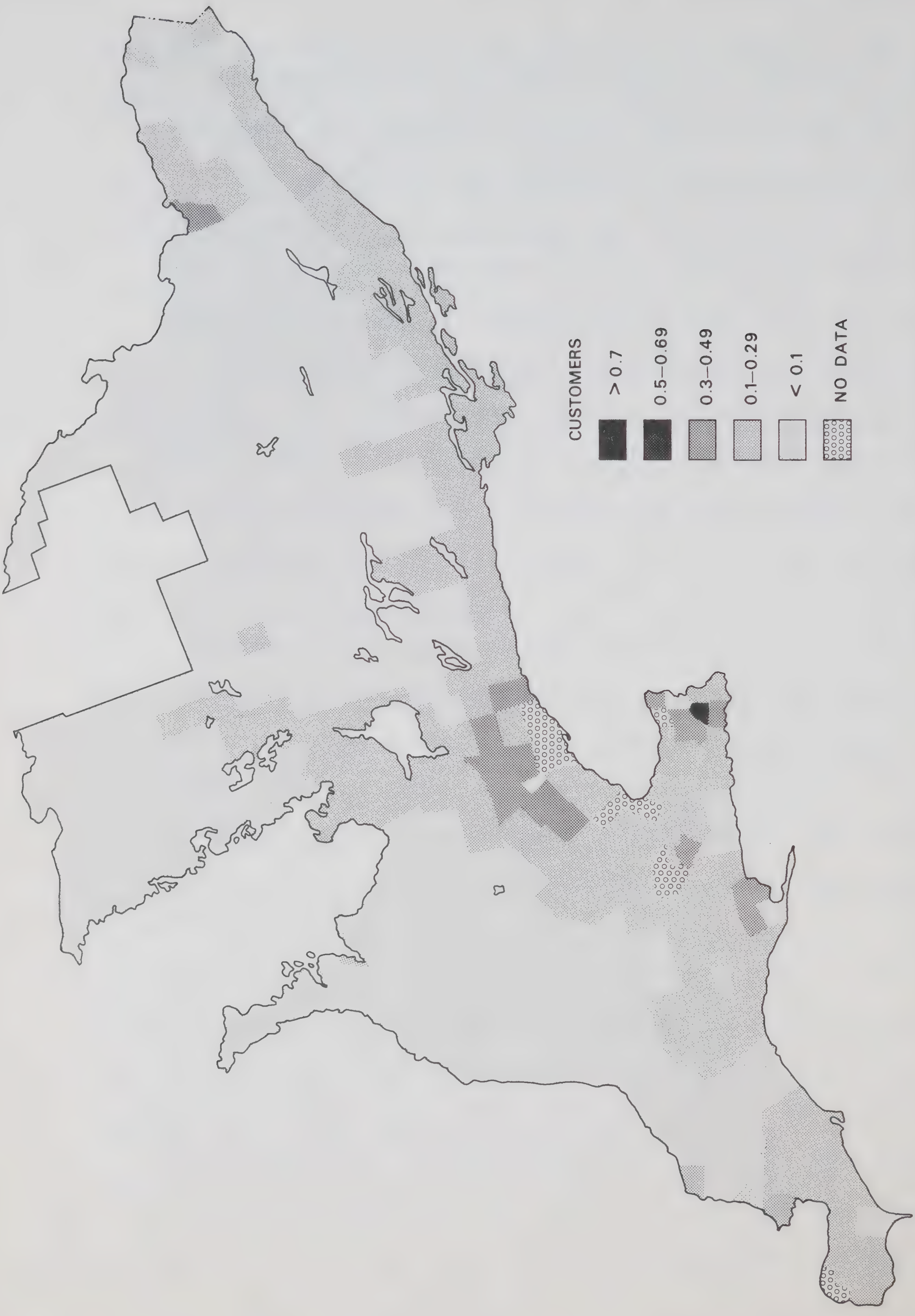
Density per 100 acres 1960		Density per 100 acres 1970				
		<0.1	0.1-0.3	0.3-0.5	0.5-0.7	>0.7
	<0.1	0.17	0.53	0.24	0.05	0.02
	0.1-0.3	0.03	0.05	0.22	0.25	0.45
	0.3-0.5	0.19	0.0	0.0	0.13	0.69
	0.5-0.7	0.0	0.0	0.0	0.0	1.00
	>0.7	0.0	0.0	0.0	0.0	0.0

based rural life which will be dealt with in the next section of the report, or in areas close to cities is a reflection of urban incorporation.

Low density rural hydro customers include all those year-round customers living at a maximum density of 6 per quarter mile road section but not meeting the criteria to be designated as farm customers. Whereas the other hydro categories examined to date exhibited declines in density or at best stability, the density of customers in this category increased rapidly from 1960 to 1970. The extent to which nearly every township participated in this can be gathered from examination of the transition matrix shown in Table 25. Four hundred and one of the 465 townships included in this analysis increased in density to such an extent as to move to a higher category from 1960 to 1970. If we assume that an average customer in this category consumed 5 acres of land the loss of land from farming during the period could be of the order of 1 to 2 acres per 100 acres in some of the townships bordering the urban areas. In other areas the density of customers is not so great, and if we assume an average density today of 0.7 per 100 acres for all of Southern Ontario, at maximum some 3% of the area of Southern Ontario occupied by farms in 1951 would have been lost to low density residential areas between 1960 and 1970.

In view of the small area of Southern Ontario apparently occupied by residential low density residences one might dismiss the trend towards an increasing density in this land use as being insignificant for agriculture. However, expansion in this use may reduce the aesthetic value of the countryside, replacing broad vistas of open landscape with a fenced, subdivided, almost suburban appearance. It may

impose additional tax burdens on other rural dwellers because of the high cost of servicing low density residences in the countryside. The low density residential phenomenon will also have to be watched closely simply because its rapid expansion is a new feature of Ontario and insufficient time has passed to study its behavior and its impact adequately. What can be discovered gives rise more to concern than complacency. The distribution of low residential density hydro customers in 1960 displays a distinct urban gradient being concentrated particularly around the larger cities (see Fig. 15). Figure 16 shows the distribution of the same variable in 1970, and while the same spatial patterns are shown as in 1960 the majority of townships increased their density from 1960. In fact, an urban phenomenon has become a feature of the whole landscape, urban and rural. This change has been particularly concentrated in the years 1965 to 1970 as the transition matrices for the periods 1960 to 1965 and 1965 to 1970 given in Tables 26 and 27 respectively demonstrate. The possibilities of a township not changing from one density group to another are given in the diagonal running from the top left to the bottom right of each matrix. In 1960 to 1965 they ran: 0.81, 0.84, 0.75, 1.0 and 0.0 (because no township in 1960 had even a density of 0.7 customers per 100 acres). In 1965 to 1970 the situation had fundamentally changed so that the corresponding vector of probabilities reads: 0.23, 0.11, 0.03, 0.0, 0.5, and the predominant direction of change was towards a rapid increase in density. Consequently, the change summarised in Table 25 for the period 1960 to 1970 primarily relates to changes which have taken place since 1965, too late to be reflected in the 1966 Census of Agriculture data so that



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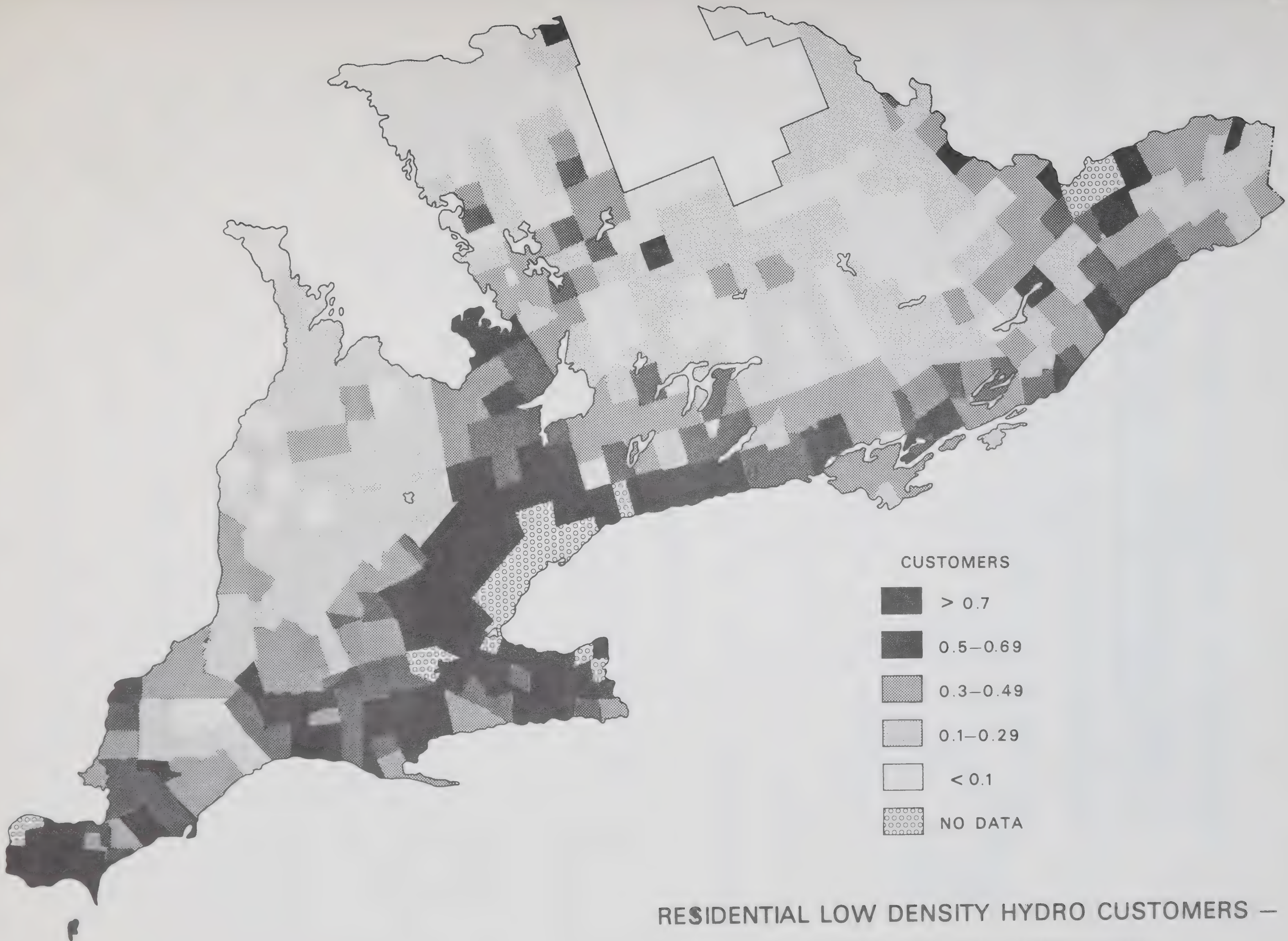
RESIDENTIAL LOW DENSITY HYDRO CUSTOMERS —
NUMBER PER 100 ACRES 1960



RESIDENTIAL LOW DENSITY HYDRO CUSTOMERS – NUMBER PER 100 ACRES 1970

16

TABLE 26

Transition Matrix for Density of Low Density
Rural Hydro Customers 1960-1965

		Density per 100 acres 1965				
		<0.1	0.1-0.3	0.3-0.5	0.5-0.7	>0.7
Density per 100 acres 1960	<0.1	0.81	0.19	0.0	0.0	0.0
	0.1-0.3	0.02	0.84	0.13	0.0	0.01
	0.3-0.5	0.06	0.0	0.75	0.19	0.0
	0.5-0.7	0.0	0.0	0.0	1.0	0.0
	>0.7	0.0	0.0	0.0	0.0	0.0

TABLE 27

Transition Matrix for Density of Low Density
Rural Hydro Customers 1965-1970

		Density per 100 acres 1970				
		<0.1	0.1-0.3	0.3-0.5	0.5-0.7	>0.7
Density per 100 acres 1965	<0.1	0.23	0.59	0.16	0.02	0.0
	0.1-0.3	0.0	0.11	0.33	0.25	0.31
	0.3-0.5	0.06	0.0	0.03	0.11	0.81
	0.5-0.7	0.0	0.0	0.0	0.0	1.0
	>0.7	0.0	0.0	0.50	0.0	0.50

its impact on agriculture cannot yet be assessed. The sheer rapidity of the change gives cause for alarm and the spreading phenomenon of rural low density residential occupancy of the countryside must be closely watched and its implications rapidly assessed before rural planning is overwhelmed by it. As soon as small area data are made available from the 1971 Census of Agriculture further research must be immediately begun on this problem.

3. Changes in the Area of Land in Agriculture in the Toronto-Centred Region and the Niagara Peninsula

The township level of data aggregation allowed urban effects in agriculture only to be consistently apparent around the Toronto/Hamilton area and, consequently, the Toronto Centred Region and the Niagara Peninsula were selected in order to ascertain the effect of proximity to cities on the amount of land devoted to agriculture. One can assume that through time land will be transferred from agricultural uses to residential and other urban orientated uses close to cities. In addition, if Sinclair's hypothesis[1] is correct, there should be an accompanying reduction in intensity of use of the land remaining in agriculture because of the speculative environment which prevails as one approaches Toronto. There is evidence of land lost to farms between 1951 and 1966 around Toronto and Fig. 17 shows the distance trends in loss of total farm area and unimproved area as one moves out from the centre of Toronto holding all other effects constant. These trends were formed by fitting the linear regression curves given below.

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[1]Sinclair, R. "von Thünen and Urban Sprawl". Ann. Assoc. Am. Geog.57, 1967,72-87.

DISTANCE TRENDS AROUND METROPOLITAN TORONTO
FOR TOTAL FARM AREA AND UNIMPROVED ACREAGE
1951 AND 1966

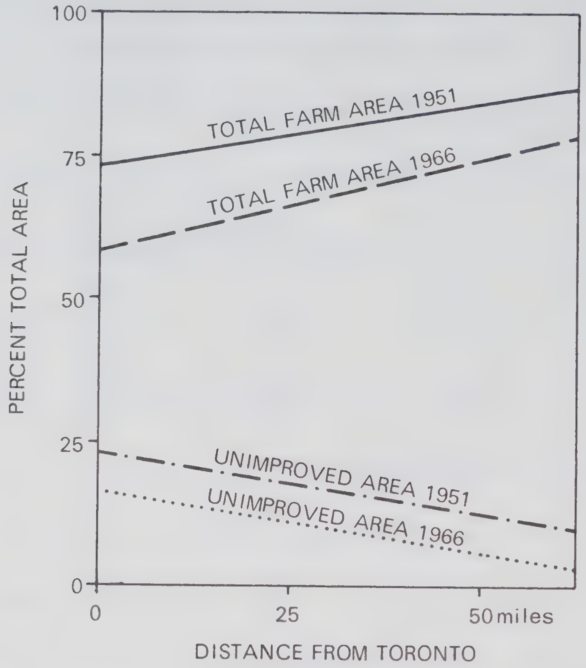


Fig. 17

DISTANCE TRENDS IN AGRICULTURAL LAND LOSS
AROUND METROPOLITAN TORONTO
1951 AND 1966

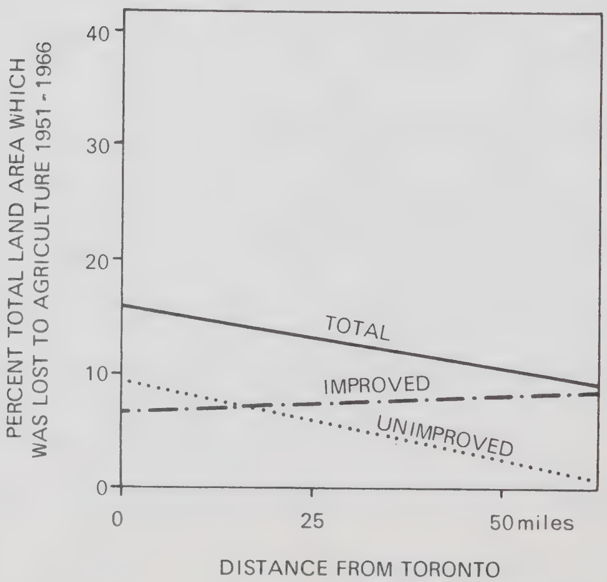


Fig. 18

Census of Agriculture Data

1951

$$X_1 = 73.83 + 0.05\ X_3 - 0.05\ X_4;\ R = 0.30$$

$$X_2 = 23.23 - 0.05\ X_3 + 0.06\ X_4;\ R = 0.38$$

1966

$$X_1 = 56.94 + 0.09\ X_3;\ r = 0.29$$

$$X_2 = 17.23 - 0.04\ X_3 + 0.06\ X_4;\ R = 0.35$$

Where X_1 = Percentage Total Land Area in Census farms in a township

X_2 = Percentage Total Land Area in Unimproved Acreages in a township

X_3 = Distance in miles from the centre of a township to the City of Toronto

X_4 = Distance to centre of nearest towns with a population greater than 100,000 excluding Metropolitan Toronto

No significant relationship could be found with distance from Toronto for improved land.

These findings suggest that much of the land lost to agriculture during the period 1951 to 1966 has been unimproved land or if improved that its loss has been compensated by a cultivation of formerly unimproved areas.

Figure 18 was constructed from the regression equations and predicts the loss of total and unimproved land away from Toronto from 1951 to 1966 as a percentage of the total land area, holding all other effects constant. It indicates that Toronto probably has had significant effect on agriculture land use up to 50 miles or more from the city. No significant effects could be found for proximity to other cities in this area which could be attributed to the effects of expanding urbanisation rather than the physical environment. The distance relationships which were found for other sizes of city did not change significantly between 1951 and 1966 and

were thought to reflect non-urban effects and were consequently ignored. Using the regression equations as a guide, one is forced to conclude that proximity to Toronto does not encourage farmers to retain land in agriculture. In 1951 and 1966 distinctive gradients in land use existed around the city. The proportion of the land area in farming increased away from Toronto, hardly an unexpected feature given the competition from urban sources for land. In agreement with Sinclair's hypothesis the proportion of the total land area in unimproved acreage tended to decline away from Toronto indicating that land close to the city probably was and still is being under-utilised by farmers. In both instances there was a significant loss of acreage between 1951 and 1966 (see Figure 18). The loss in improved acreage as a percentage of the total area is also plotted on Figure 18. No relationship with distance from Toronto could be found for improved acreages but clearly proximity to the city resulted in the loss of significant acreages between 1951 and 1966. There is little evidence of any intensification of use of the land remaining in agriculture in 1966 in the sense that improved land and cropland as a percentage of total township farmland could not be significantly related to distance from Toronto in either 1951 or 1966 (but not in the sense of intensity used later on in this report). The evidence if anything suggests the opposite, for the area of unimproved and pastureland as a percentage of total township farmland was not significantly related to distance from Toronto in 1951 whereas in 1966 a significant relationship did exist which indicates that both variables tended to increase approaching Toronto.

One is forced to conclude from this data that the effect of proximity to Toronto on the land available for agriculture and on the intensity of its use is negative. Land is leaving farming at a significant rate - Figure 17 predicts a loss between 1951 to 1966 of approximately 10 percent fifty miles away. Besides indicating a retrenchment of agriculture in the area this also probably indicates a reduction in the amenity value of the land to the general public, particularly when the land is occupied by rural low density residents. In addition, similar forces are likely to be at work around other cities at a scale too small to be picked up from township data. The loss of farmland is likely to have a depressing effect on agriculture in such areas which makes remaining farms even more susceptible to urban competition. One should therefore not necessarily expect that the loss of land from agriculture will continue at a smaller scale in the future than in the past.

4. The Spread of Recreation Uses 1960-1970

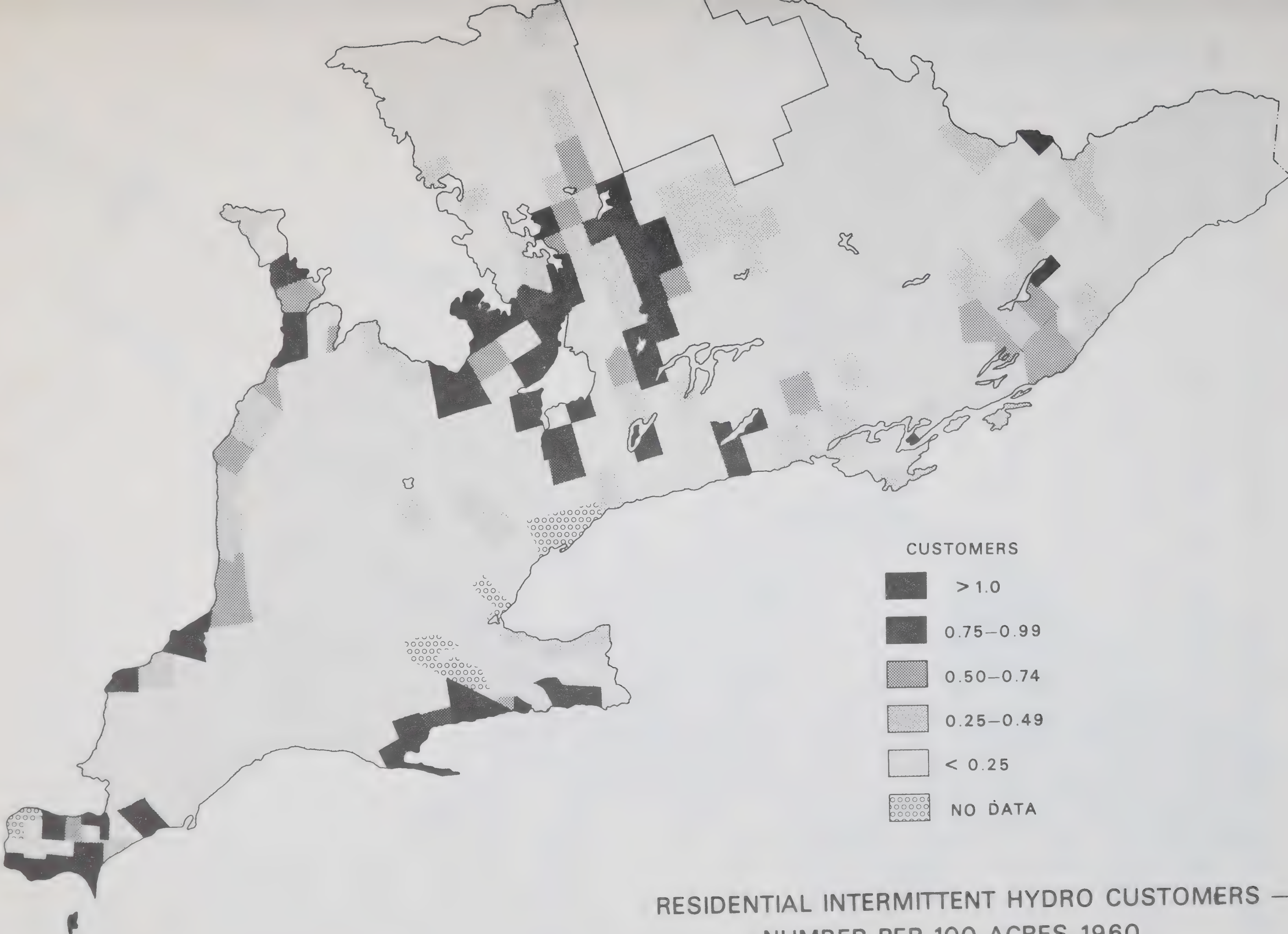
It is also argued that recreation is a serious competitor for land in agriculture. In certain areas this may be so. The area immediately around cities is one such area where golf courses, riding schools, and private parks are becoming more numerous than in previous years. Other areas, whilst attractive to recreational uses because of their scenic qualities, are quite unsuitable for agriculture because of the ruggedness of the terrain. Some areas close to more rugged areas or close to water are attractive both to agriculture and to recreation, but these are relatively limited in their spatial extent. In such areas the invasion of residential and commercial intermittent seasonal hydro customers between

1960 and 1970 is quite noticeable. Figures 19 and 20 show the density of residential intermittent hydro customers in 1960 and 1970 respectively. The same areas stand out on both maps although densities are higher in 1970 than 1960.

The coastal townships of Lake Erie and Lake Huron together with the Windsor area, Muskoka - Lake Simcoe area and the Rideau Lakes area are the most popular areas for this type of hydro customer and here the loss of land from agriculture to recreation is likely to be significant. It must be remembered that even in these areas competition is greatest closest to water and will rapidly decline away from shorelines. Consequently, although a distinctive pattern of competition does exist, its impact on agriculture is likely to be local and insignificant when compared with losses of land to rural low density residents and to the influence of Toronto.

5. The Response to Marginality, 1951 to 1966

Figures 12 to 14 indicate that loss of land from agriculture is a widespread phenomenon which cannot be attributed to any extent to some areas more than others. It was expected that soil quality or physical potential for agriculture would be a factor in land loss but this did not prove to be the case for no significant relationship could be found between loss of farmland, unimproved or improved acreage in a township and the proportion of land in soil classes 1 to 3. Land leaving agriculture would appear to be more a function of the availability of purchasers than the physical potential of an area for farming, and land does not appear to be abandoned on the Shield because of its poor physical quality any more than land is being retained in agriculture in the western half of the study area because of its relatively good physical quality.



RESIDENTIAL INTERMITTENT HYDRO CUSTOMERS –
NUMBER PER 100 ACRES 1960

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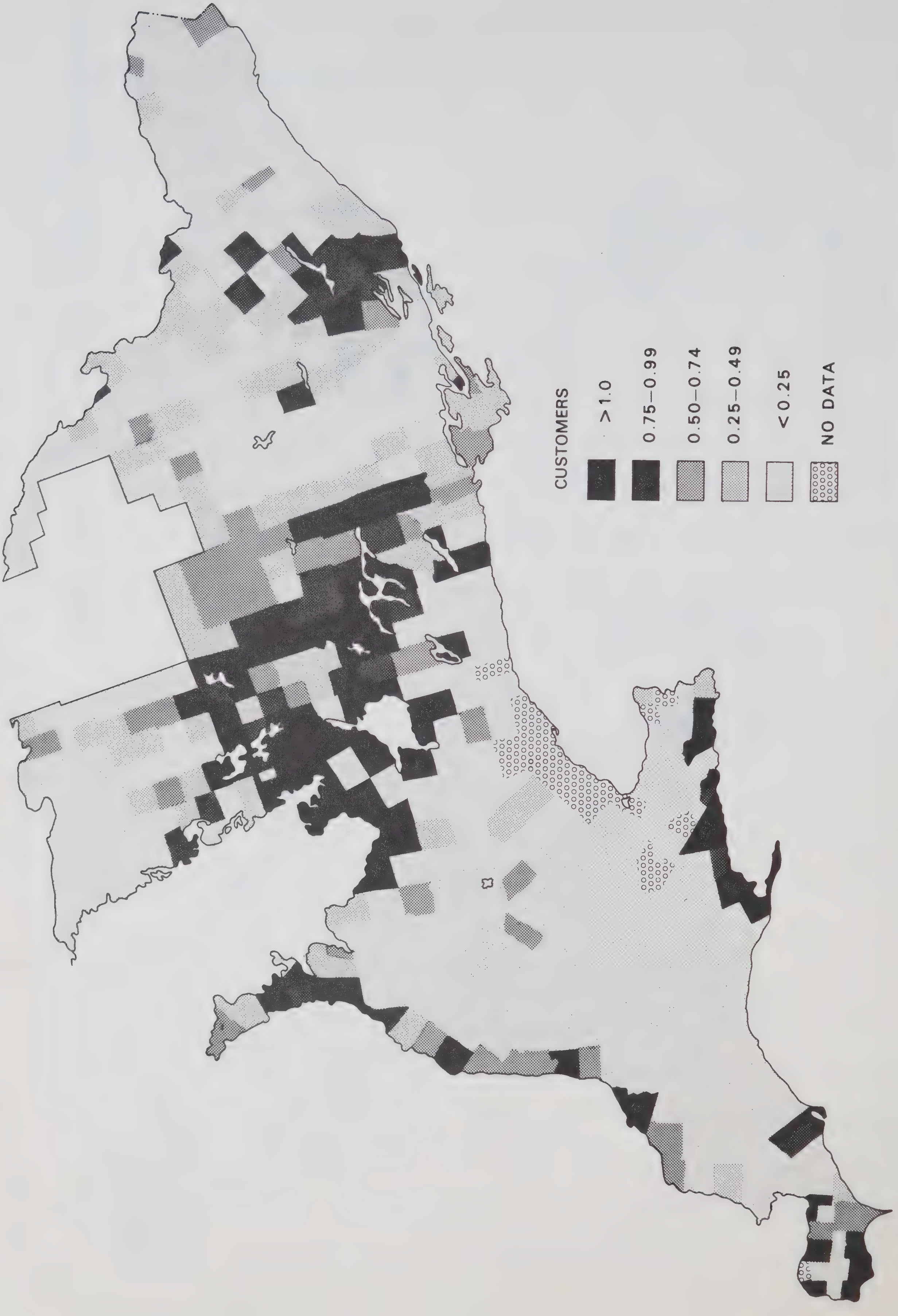

RESIDENTIAL INTERMITTENT HYDRO CUSTOMERS —
NUMBER PER 100 ACRES 1970

Time did not permit developing a comprehensive model of the land conversion process. A modest attempt was undertaken to determine the effect of some factors on the change in farm land by means of a regression equation. The change in farmland acreage per township between 1961 and 1966 constitutes the dependent variable (X_1). Some of the townships around Toronto were excluded, leaving 451 townships in the analysis. The independent variables used were, (1) unimproved land as a percentage of total farmland in 1961 (X_2), (2) farmland as a percentage of the total township area in 1961 (X_3), (3) distance from Toronto (X_4), (4) the change in rural low-density hydro customers between 1965 and 1970 (X_5), (5) the change in rural intermittent hydro customers between 1965 and 1970, (X_6). The rationale for the use of a different time span for variables X_5 and X_6 than for X_1 is that there is a time lapse from when land is released from agriculture and when the ultimate user is registered as a hydro customer. The variables included were all significant at the 5 percent probability level and the signs of the regression coefficients are all in accordance with those expected[1]. The correlation coefficient, however, was low. Only 9 percent of the variation in the change in farmland acreage among townships can be explained by the included variables.

The majority of changes in the farm area of townships between 1961 and 1966 was negative, and with this in mind the regression equation indicates that the most significant variable of the five used to predict the change in area was the percentage of unimproved land followed by the percentage of the total land area of a township in farming in 1961. The

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[1] $X_1 = 1137.77 - 38.67\,X_2 - 16.13\,X_3 + 1.48\,X_4 - 2.56\,X_5 - 2.66\,X_6$; $R = .32$. Upon standardization the β coefficients which indicate the relative importance of variables X_2 to X_6 in explaining variations in X_1 are: for X_2, -0.37; for X_3, -0.18; for X_4, 0.11; for X_5, -0.16; and for X_6, -0.10.

next most significant variable was the increase in low density rural hydro customers 1965 to 1970 which had roughly one and a half times the effect of the increase in rural intermittent customers over the same period. The effect of this latter variable was only about a quarter that of the area in unimproved land. As expected, the greater the increase in hydro customers in both variables, the greater the loss of farmland. Distance from Toronto, as expected, had a significant effect on the loss of land from farming, and as in the previous use of this factor, loss declines away from Toronto, indicating the decline in urban competition for land away from the city.

The fact that only 9 percent of the variation in changes in the area in farms 1961 to 1966 has been explained by this model suggests that significant factors have been omitted. No measure of the amount of land speculation taking place in townships has been included. No attention has been paid to losses due to highway construction, high density residential construction, afforestation, hydro power lines, and the like. Consequently, we are not in a position to explain why farmland loss occurred during the study period, but land is leaving farming at such a rate that a comprehensive study of the problem should be undertaken. Instead, we concluded that certain variables are significant in this process and that their possible effects in the future should be closely monitored.

In Sum: This section has considered the apparently more significant contemporary competitors with agriculture for land. Indications are that the rapid spread of rural low density residences will prove to be a movement of major importance to rural areas in Ontario in the 1970's.

At present the significance of this phenomenon to agriculture has still to be properly assessed but its effect would not appear to be positive. The loss of land around Toronto has serious implications to the agricultural industry of that area for it is of such a scale that the whole industry could collapse. Apart from around urban areas competition with recreational uses is not likely to be significant except in very local areas. Marginal physical environments are not experiencing any greater or less land loss than more favorable areas, and it must be concluded that the remaining "unexplained" loss of land must be largely accounted for by the general cost/price squeeze which has inflicted the agriculture industry in Ontario more than most branches of the economy. This would account for the widespread losses shown in Figures 12 and 14. The influx of low density rural residents into the countryside is not likely to improve the situation, for the cost of rural life may rise, leading to a further cost/price squeeze for agriculture and an increase in economic if not physical marginality and the further loss of land to agriculture[1].

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[1] Recently released tabulations from the 1971 Census indicate that Southern Ontario lost 9 percent of its farmland between 1966 and 1971 compared with only 12 percent over the fifteen year period 1951 to 1966. Clearly the rate of loss of farmland has increased significantly and must give rise to concern.

CHAPTER 4

SELECTED AGRICULTURAL RESPONSES TO CHANGE

Agriculture in Southern Ontario is not a closed system. Rather it responds to stimuli and pressures from competing areas of production and from other sectors of the provincial, national and international economy. Thus it functions as part of a larger socio-economic system. Within the agricultural system of Southern Ontario processes of adoption and diffusion reflect internal pressures for change as well. It is important in planning for agriculture in Southern Ontario that both internal and external forces for change be recognized.

Clout suggests that planning for rural areas is now developing rapidly in response to three major trends:

> "First, modern largely urbanized societies are making increasing demands on their rural and suburban surroundings and are changing the sociological, economic, and land-use components of these environments which were established in the past...Second, the technological changes affecting modern farming demand that the scale of agricultural structures (fields, farms, and land-use patterns) should be enlarged for economic viability in the future...Third, many rural areas are rapidly being depopulated and, in view of these changes in occupance, new policies need to be developed for the provision of services in the future and for the expansion or contraction of settlements."[1]

These trends have certainly been evident in Southern Ontario for some time and are reflected by the many pressures for change being felt by the farmers of the region. There are numerous responses to these pressures, responses that can be measured in various ways and that are spatially variable in the degree and direction of the resultant change.

Changes that reflect a number of the more significant of these

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[1]H. D. Clout, "Planning Studies in Rural Areas", Ch. 21 in R. U. Cooke and J. H. Johnson (eds) Trends in Geography: An Introductory Survey, Oxford, 1969, p. 222.

responses have been analyzed for Southern Ontario largely through the use of maps, tables and supporting text. The period for analysis has for the most part been from 1951 to 1966 and the major source of data has been the Censuses of Agriculture for Ontario.

The analysis of change falls into three broad categories:

1. changes that reflect the response of agriculture in aspects related to the cost-price squeeze and technological change
2. changes that reflect the response of agriculture in aspects related to the allocation of land between farmers and nonfarmers
3. changes that reflect the response of individual farm operators to the pressures for changes.

These categories are not mutually exclusive nor are the changes analyzed all inclusive. They reflect the constraints of the data and selectivity by the researchers in seeking some of the more significant responses.

FARM POPULATION AND NUMBER OF FARMS

In the years from 1951 to 1966 the farm population of Southern Ontario declined from 634,592 to 467,703 or by some 26.3 percent. This is not only a continuation but an acceleration of a trend that was initiated much earlier. This decline in farm population has been accompanied by a decline in number of farms. In 1951 there were 137,022 farms in Southern Ontario while in 1966 there were only 104,115, a decline of 24 percent[1]. This decline in farm population and farm numbers is a well-known aspect of agriculture's response to changing circumstances.

The movement of people out of agriculture consists largely of three groups: surplus youth, displaced farmers and their families, retired farmers and their spouses. The movement of surplus youth out of farming does not lead immediately to a decline in number of farms but may be reflected later in units ceasing to exist when no sons are left interested in carrying on the operation.

The retirement of farmers, given the situation above, the pressures for consolidation and the costs of entry into farming will often mark the time when an operation ceases to exist. Given further that aging operators will be generally less willing to invest in extra land and structures, farm units made available upon retirement are probably less likely to be viable under conditions prevailing when retirement occurs.

The movement out of agriculture of the displaced farmer groups also contributes to the reduction of farm numbers. It is difficult to

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[1]The definition of a census farm was changed between 1951 and 1966. The definition used in 1966 was less liberal than in 1951. This serves to make the figures for both farm numbers and farm population in 1966 somewhat lower than they would be otherwise. It also served to reduce the number of non-commercial farms.

state with any assurance how selective out-migration in relation to farm income is among farm operators in the displaced farmer group. The opportunity cost of farming is not the same for all farmers and non-economic factors also come into play. It is not always the less successful producers that abandon farming. Around urban areas the upward pressure on land prices may induce many to sell their land because returns from agriculture are not commensurate with what can be made by investing the capital acquired through sale. If such sales take place well in advance of a change of use the farmer may, however, often continue to operate the land. Often, however, the land is rented and used frequently less intensively by other farmers.

The effect of both retirement and displacement on farm population and farm numbers is of course tempered by the fact of entry into agriculture. The average age of farmers in Southern Ontario increased only slightly from 1951 to 1966. There are other restraints on the reduction of farm population and farm numbers working as well, perhaps the most significant being the response expressed through part-time farming, dealt with later in this report. In addition, urbanites add to the ranks of the part-time farmer response by purchasing units, residing on them and producing sufficient sales from them to qualify as part of the farm population.

While it is not always the less successful farmers that abandon agriculture and not always the less viable units that become consolidated upon the retirement or displacement of operators, out-migration from agriculture has in part been a selective process. Consequently this trend to fewer farms in part accounts for the fact that a decreasing proportion of farms are small scale farms or in the lower sales categories among commercial farms. Table 28 shows the proportion of farms with sales within specified

TABLE 28

Census Farms Classified by Sales Categories
Southern Ontario

	1951		1966	
Value of Products Sold	%	Cumulative %	%	Cumulative %
$10,000 and over	6.0	6.0	27.8	27.8
5,000 to 9,999	16.6	22.6	20.8	48.6
3,750 to 4,999	11.4	34.0	7.8	56.4
2,500 to 3,749	16.9	50.9	9.6	66.0
1,200 to 2,499	21.5	72.4	12.8	78.8
Under 1,200	27.7	100.1*	21.3	100.1*

* Due to rounding

Source: D.B.S., Census of Agriculture, Ontario, 1951 and 1966.

values for 1951 and 1966 as well as the cumulative proportion of farms with sales above specified values. Using the 1966 census definition of a commercial farm (sales over 2500 dollars), while 50.9% of Ontario's farms were commercial in 1951 some 66.0% so qualified in 1966. But of course gross sales of 2500 dollars are not really comparable between the two dates. It would perhaps be more realistic to compare 2500 dollar sales in 1951 with sales of 3,750 or 5,000 dollars in 1966. Here the changes have not been so marked. Given the 95% increase in value of sales in the 15 year period and the 24% decline in number of farms there still remain in relative and absolute terms a large number of farms providing only low returns to the operators[1]. What has basically occurred is that a much greater proportion of sales is accounted for by the top 10 or 20 percent of the operations. Decline in farm numbers obviously has to be used with caution as an indicator of a selective adjustment process reducing the number of less viable operations. Intensification as well as consolidation is a very important factor in Southern Ontario by which farmers seek to achieve higher incomes, and would appear to be the more important process by which those remaining in agriculture improve their income status.

Figure 21 shows the percent change by township in numbers of farms from 1951 to 1966. The patterns on this map lend themselves readily to broad regional generalization. The Shield area stands out as a region with the most marked decline in farm numbers. Judging from data regarding the decline in the number of farmers and changes in farm size the land thus released has not for the most part been absorbed into units remaining in

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[1]As will be seen later this is in part counterbalanced by the fact that a greater proportion of farms were "part-time farms" in 1966.

PERCENT CHANGE IN NUMBER OF FARMS 1951—1966

operation. Actual output in dollar value has declined and sales per farm have not increased appreciably at all, although farms are larger.

Eastern Ontario emerges as a region with moderate declines in farm numbers. Appreciable amounts of land have been made available to those remaining in farming, this being reflected in larger operations. The relatively poor performance in increase in value of output per farm suggests that other factors have been more important than the opportunities provided by larger acreages.

Throughout most of south central and southwestern Ontario decline in farm numbers have been well below average. Farms have not become much larger but the increase in the value of non-land inputs has been appreciable. Value of output per farm has increased more than in any other region. In much of this area intensification rather than farm enlargement has been the most important means to higher sales per farm. This of course does not mean that all farms have shared equally in this change. In this region the effects of urbanization on farm numbers is readily apparent. The urban arc around the western end of Lake Ontario and townships within which the major urban centres are located have recorded substantial declines in farm numbers, and of course marked declines in farmland as well.

In summary there has been a substantial decline in farm population and farm numbers in Southern Ontario. This decline has not been spatially uniform. Declines have been most pronounced in the less prosperous agricultural areas but even when a portion of this land has remained in agriculture resulting in larger farms, this has not had noticeably salutory effects on the viability of units remaining in operation. The selectivity of the decline as related to income status has not been particularly marked, a

substantial proportion of farmers still have low farm incomes.

It should be noted that a declining farm population has other implications that may be as important. In some areas the strength and vitality of rural social organizations and the future of hamlets and villages are undoubtedly seriously affected. The nature of the relationship between these and viable agriculture is probably not uni-directional but reciprocal. Too few farmers may be a serious problem as well as too many. In some areas of Southern Ontario this may have already occurred. Significant acreages have been released in the Shield area but this has seemingly been of little benefit to those remaining despite the fact that some of this land has remained in agriculture and farm sizes have increased. This may reflect in part the collapse of the infra-structure needed to support the industry.

AGE OF FARM OPERATORS

The age of farm operators in a given area may be used as an indicator of the vitality of farming in that area. Often a relatively old population is symptomatic of pressures which discourage the young from entering farming. Indeed, farm operators as a whole in Ontario are relatively old. This is illustrated by comparing farm operators to the province's entire labour force. In 1961, 35.9 per cent of Ontario's farm operators were over the age of 54 while only 16.2 per cent of the entire labour force was older than 54.

TABLE 29

Percentages of Farm Operators in Various Age Categories,
Southern Ontario, 1951, 1961, 1966

Categories	1951	1961	1966
< 25	2.5	1.9	1.7
25-34	14.8	12.8	11.9
35-44	23.8	23.2	23.2
45-54	25.7	26.2	26.5
55-59	11.2	12.2	12.1
60-69	15.3	16.8	17.6
70+	6.8	6.9	7.0

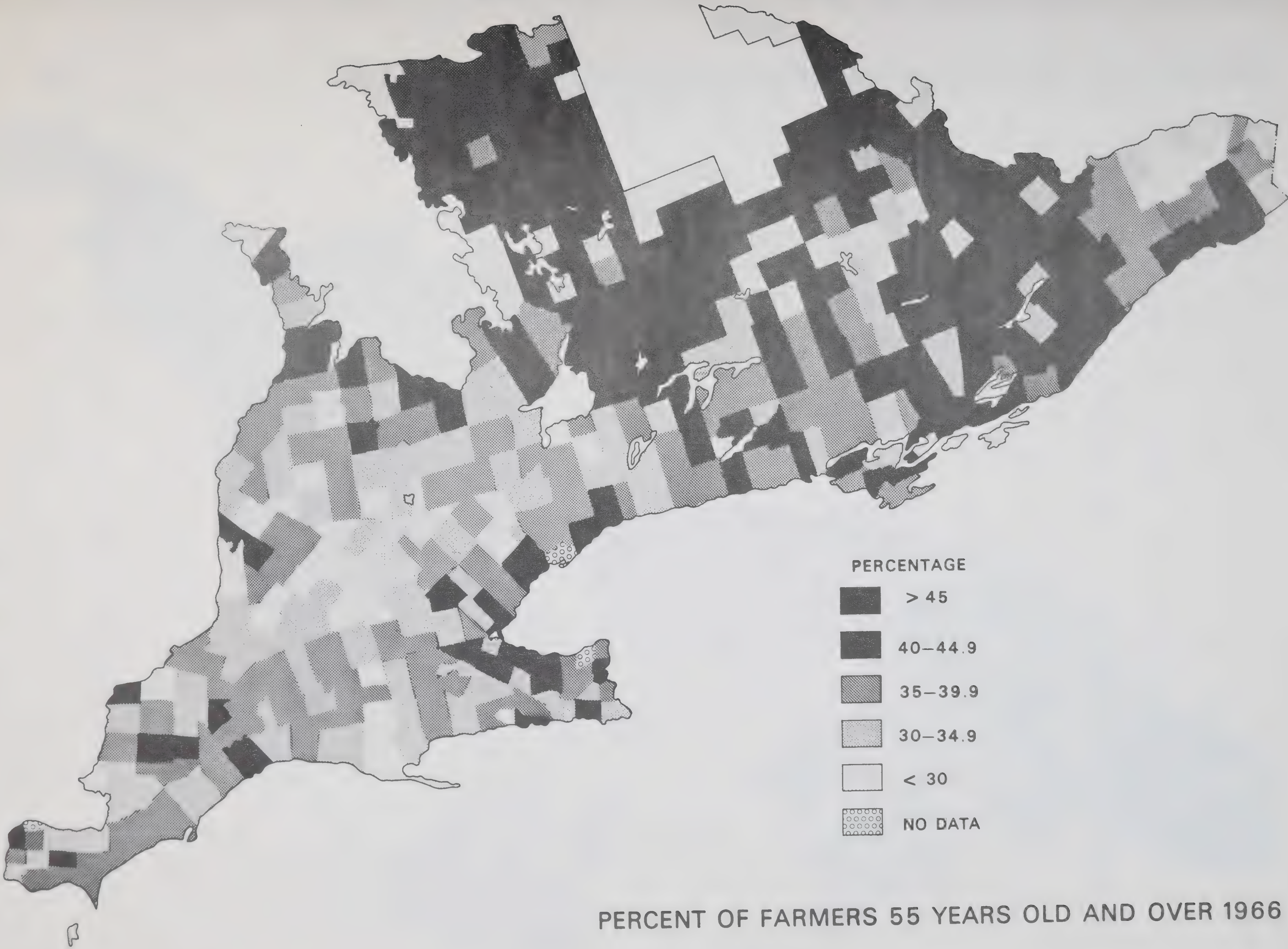
Source: Census of Canada, 1951, 1961, 1966.

As illustrated in Table 29, the proportions of farmers in the various age groups remained quite stable between 1951 and 1966 in the 45 county study area of Southern Ontario. There was a slight tendency for the older categories to increase proportionally and for the younger categories to decrease. This is largely a reflection of two factors.

Firstly, the increasing capital commitment required to enter into farming prolongs the period before a prospective entrant can afford to begin farming. Secondly, rationalization of farm numbers due to economic pressure has affected the more mobile and less committed younger farmer more than his older counterpart.

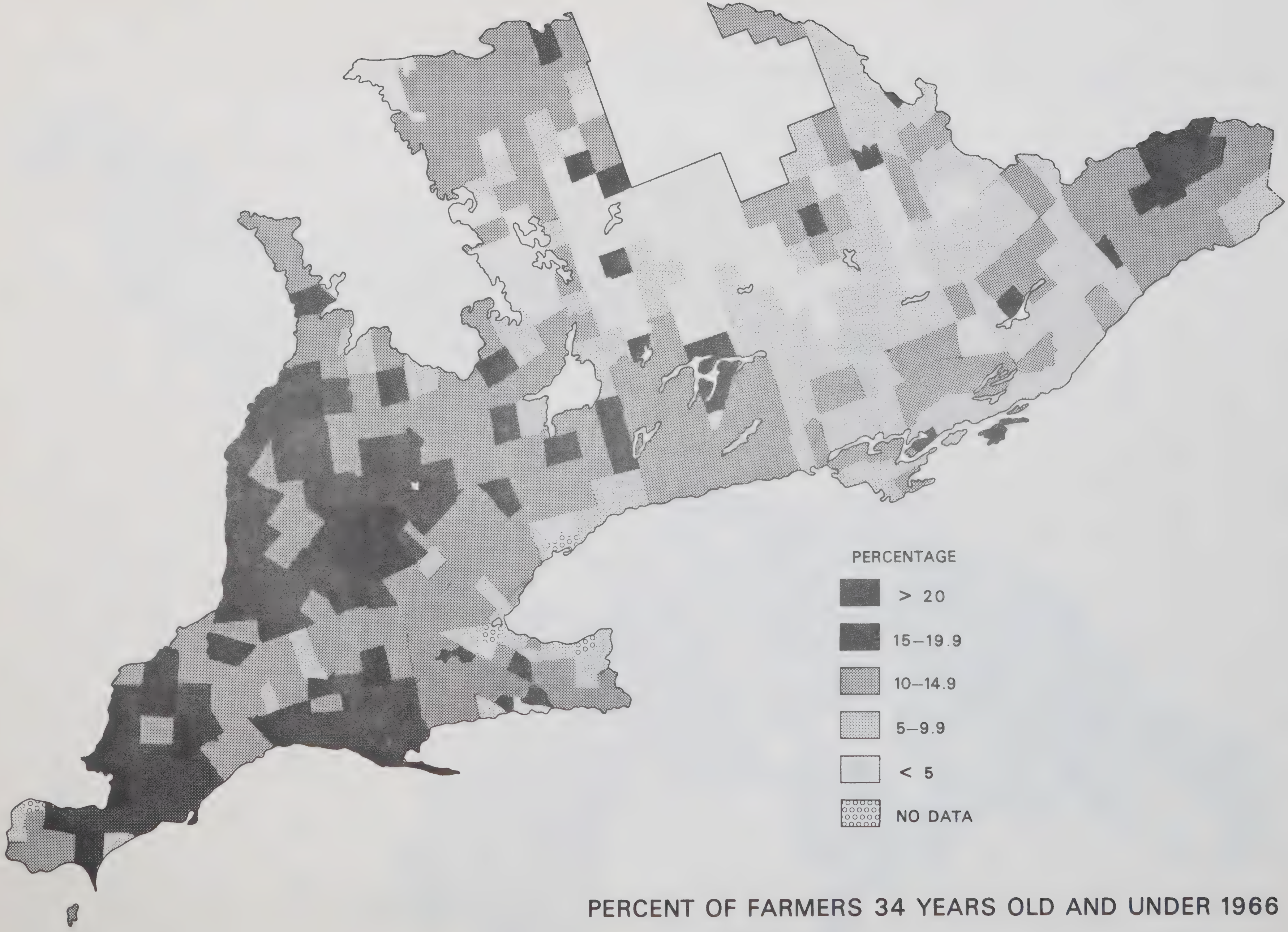
Mapping the distribution of the various age groups is useful in identifying those areas which exhibit a high degree of vitality in terms of recent entrants. For simplicity, the age categories were reduced to three, a younger group of less than 35 years, an older group of greater than 54 years and a residual category of farmers 35-54 years old. The younger and older groups were mapped as proportions of all farmers by township for 1966 and are presented in Figures 22 and 23. Figure 22 indicates that townships with relatively high proportions of farmers older than 54 were located mainly on the Shield and to a smaller extent around Georgian Bay and in the Golden Horseshoe. In 36.4 per cent of Southern Ontario's 486 townships, 40 per cent or more of the farmers were older than 54. In Figure 23 it may be seen that townships with relatively high proportions of farmers younger than 35 in 1966 were located mainly in Southwestern Ontario outside of the Golden Horseshoe region. A much smaller cluster of such townships occurred east of Ottawa. In 25.3 per cent of the townships, more than 15 per cent of the farmers were under 34.

It would seem that the association of older farm operators with the Shield area reflects lack of opportunity for new entrants into farming - a poor land base and a relatively poorly developed farm-land area. Indeed the proportion of farmers in the age group 34 and



PERCENT OF FARMERS 55 YEARS OLD AND OVER 1966

22



PERCENT OF FARMERS 34 YEARS OLD AND UNDER 1966

23

under was positively correlated with both proportion of soils in capability classes 1 and 2 and proportion of farmland area which was improved (486 townships; R = 0.618)[1]. Hence, younger farm operators were associated with both the best soils and with more highly developed agricultural areas. It may thus be concluded that those areas which exhibit the greatest opportunities for agriculture also show indications of the greatest vitality in terms of age of operator.

The proportion of farmers older than 54 was negatively correlated with both soil capability and farmland improvement. However, the correlation coefficient (0.495)[2] was lower than that of the younger age group. This is chiefly a function of the two locations for the older group, on the Shield and in the Golden Horseshoe area. The high cost of land and lack of future opportunity due to urban expansion in the latter area is a factor discouraging young farmers there. In both areas, the proportionally higher loss of land from agriculture is expedited by relatively older farm operators.

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[1] Using the T-test, all relationships proved significant at the .05 level.

[2] All relationships significant at .05 level.

TYPES OF AGRICULTURE

Figure 24 shows nine types of agriculture in Southern Ontario for 1951 based on the mix of commodity sales. The gross sales data of Table 30 are spatially reflected by the areal dominance of the livestock speciality types on the map and reflect further the fact that a large proportion of the feed crops produced are converted through livestock on integrated farm operations. Within the livestock speciality types most townships emerge as general livestock indicating that no particular livestock commodity accounted for over 50% of sales. Only a relatively small number of townships emerge as dairy emphasis or cattle and calf emphasis, the major area of the former lying north of Kingston and of the latter east of Lake Simcoe in 1951.

Areas with a more even balance between livestock and crop sales (mixed agriculture) are scattered but form more contiguous areas in a concentric zone around Algonquin Park (an area of insignificant sales) and in the southwest centred on Kent County. Within this general group townships with a livestock emphasis are the more numerous. Only a few townships in the Kent-Essex border form an area where mixed agriculture exhibited a grain and other field crop emphasis but the contiguous zone to the east forms the most significant area of mixed agriculture - general.

Three major areas emerge where special crops (forming the special agriculture group) dominated commodity sales in 1951:

(a) the Norfolk tobacco belt, including adjacent townships in neighboring counties, and including a significant horticultural component on its eastern boundary

LEGEND FOR MAPS 24 & 25

LIVESTOCK SPECIALITY (over 75% sales from livestock and livestock products)

Dairy Emphasis (dairy products over 50% of sales)

Cattle and Calf Emphasis (cattle and calves over 50% of sales)

General (livestock and livestock products over 75% of sales but no sub-group dominant)

MIXED AGRICULTURE

Livestock Emphasis (50 to 75% sales from livestock and livestock products)

Grain and Other Field Crop Emphasis (50 to 75% sales from grain and other field crops)

General (no commodity group dominates sales)

SPECIAL AGRICULTURE (horticultural crops and potatoes,roots,tobacco over 50% of sales)

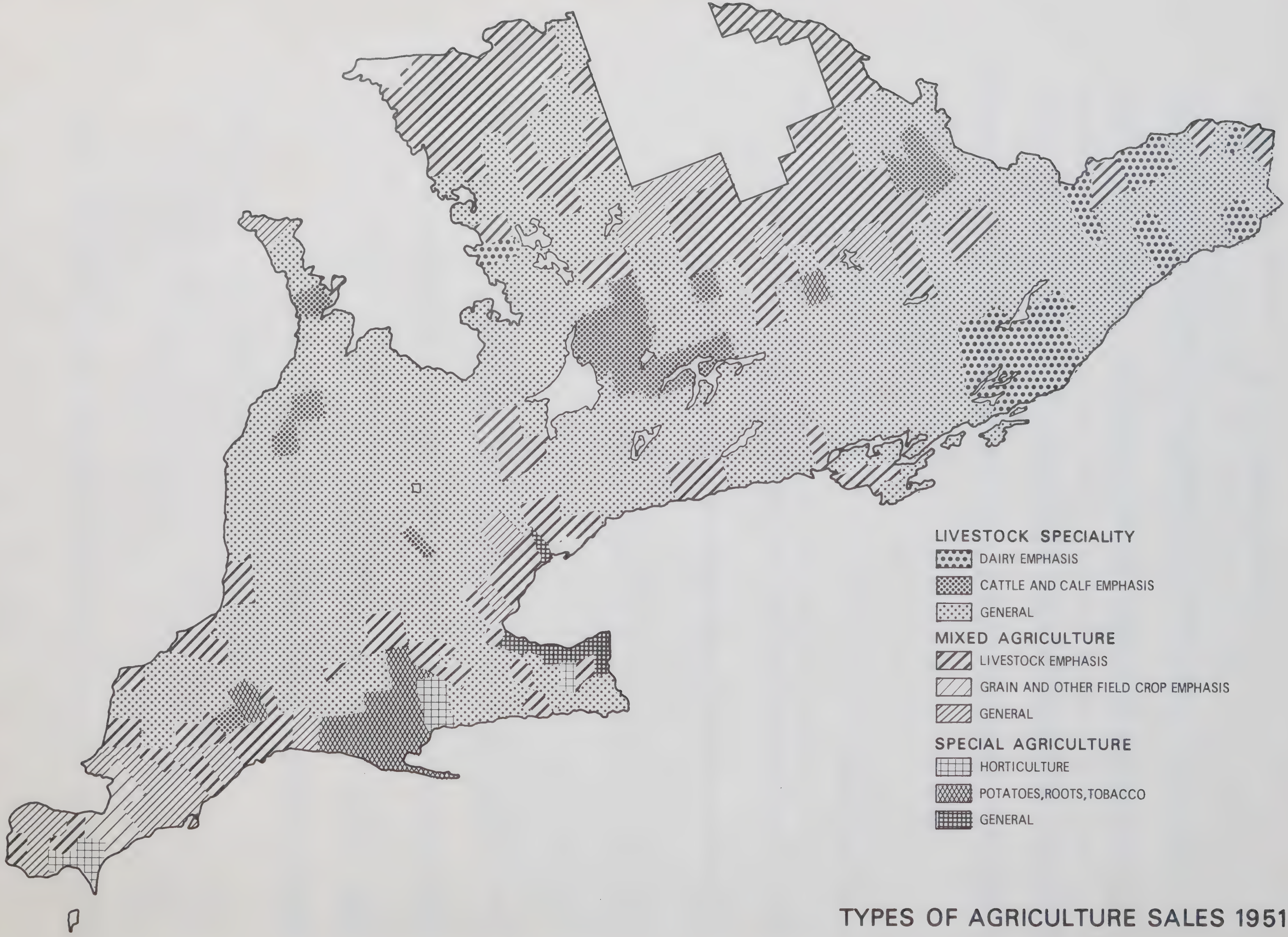
Horticulture (vegetables,tree fruits,small fruits,greenhouse and nursery over 50% of sales)

Potatoes,Roots,Tobacco (over 50% of sales)

General (two groups over 50% of sales)

OTHER

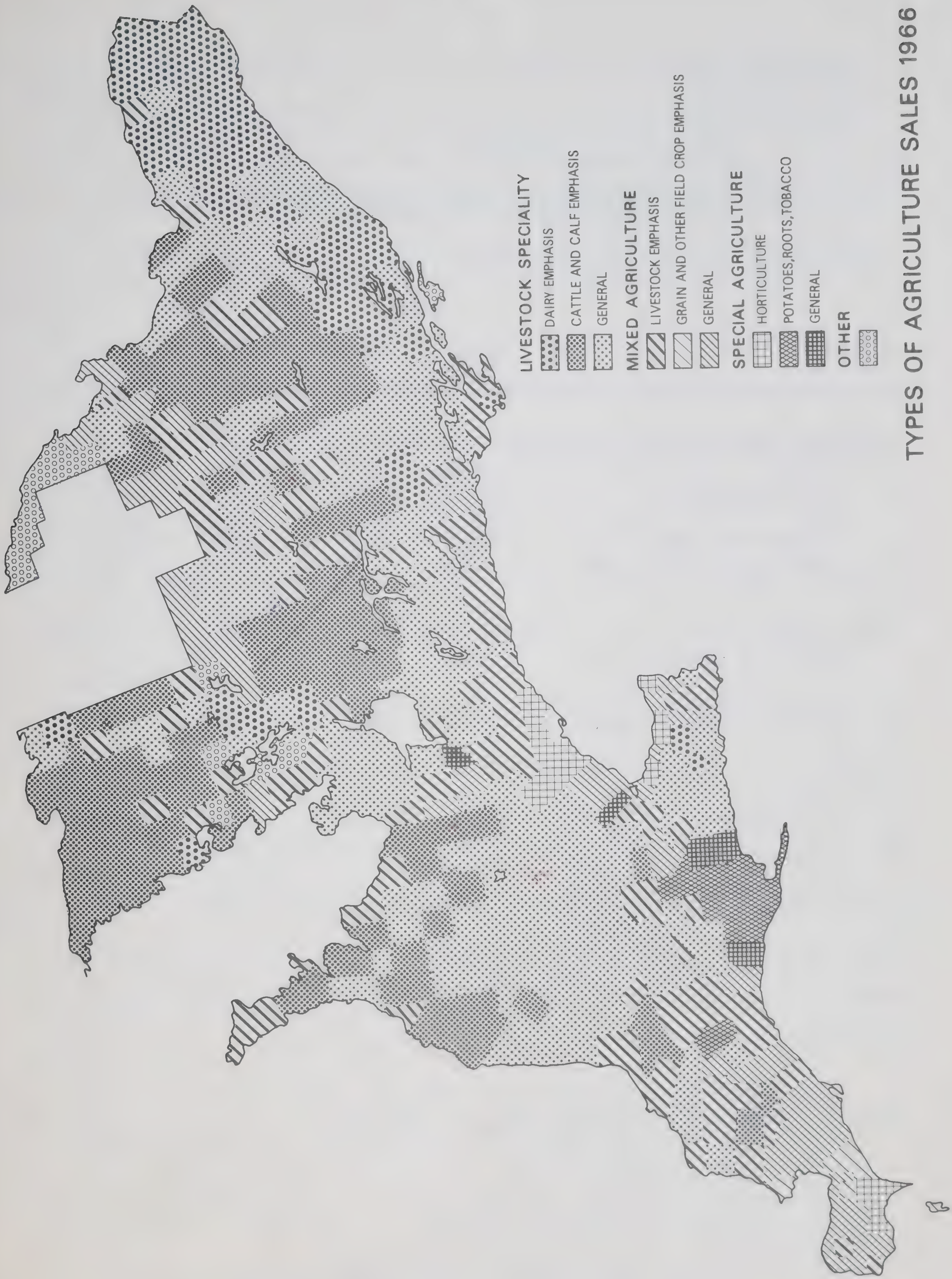
(hay and fodder,forest products and other agricultural products over 50% of sales)



TYPES OF AGRICULTURE SALES 1951

24

25



TYPES OF AGRICULTURE SALES 1966

TABLE 30

Absolute and Proportional Value of Major Agricultural Products Sold
Southern Ontario 1951 and 1966

	1951		1966	
Product	Value ($000)	%	Value ($000)	%
Livestock and Livestock Products				
Cattle	127836	24.6	258134	25.4
Dairy Products	110158	21.2	185249	18.3
Pigs	79728	15.3	134338	13.2
Poultry and Eggs	50083	9.6	103015	10.2
Sheep (incl. wool) and Horses	5050	1.0	68.5	.7
Field Crops				
Wheat and Other Grains (Incl. oil seeds)	40663	7.8	77196	7.6
Hay and Fodder	5921	1.1	10241	1.0
Potatoes, Roots, Tobacco	57226	11.0	117501	11.6
Other Crops				
Vegetables	12050	2.3	33505	3.3
Tree fruits and small fruits	17605	3.4	28998	2.9
Greenhouse and Nursery Products	9836	1.9	39763	3.9
TOTAL	516156	99.2	994755	98.1

Source: Census of Agriculture, Ontario, 1951-1966.

(b) the Niagara fruit belt forming a continuous strip from Hamilton to Niagara Falls with tree and small fruits the most significant sales group within the broader range of horticultural products

(c) an area in southeastern Essex where vegetables formed the most important group within a mix of special crops that was broader than the other two areas.

In comparing Figures 24 and 25, showing agricultural types for 1951 and 1966, the similarity between the patterns of areal specialization based on commodity sales is quite striking. This is not surprising when one compares the proportional values of agricultural products sold in 1951 and 1966 as presented on Table 30. With a few minor exceptions the contribution of each commodity type to total sales has remained virtually unchanged. This has not, however, precluded a trend toward greater areal specialization.

The most widespread change has occurred within the livestock specialty types. The area shown as livestock general is areally much more restricted in 1966 than in 1951. Townships within the livestock specialty types emphasizing cattle and calves have increased markedly in number and form a distinctive pattern. They are concentrated in areas of more extensive farming coincidental with the Shield and the Grey-Bruce area. The former is an area where the value of sales declined between 1951 and 1966 while across much of the latter area sales values increased at a rate well below average (see Figure 28). The fact that cattle and calves sales are relatively more important in these areas suggests the type of agriculture that has proven relatively most successful. In eastern Ontario general livestock has yielded to dairy emphasis in terms of the contribution made by the various commodities to sales. In many cases this change has been

accompanied by a marked decline in the absolute as well as relative value of pig sales and in some cases by an absolute as well as relative decline in cattle and calves sales. These trends suggest a significant shift at the farm level to much more specialized dairy operations. In the townships that have remained in the general livestock category individual operations may well have become more specialized. Unfortunately the product type classification of commercial farms used in the census does not make it possible to examine this satisfactorily.

In southwestern Ontario expansion of the mixed agriculture types - livestock emphasis and general - at the expense of general livestock and grain and other field crop emphasis is notable. (The total number of townships in the livestock emphasis type has remained little changed due to a marked decline of this type in the shield area). The movement from general livestock to mixed agriculture livestock emphasis partly reflects the marked increases in grain corn acreage in the area. Corn as a cash crop has become a significant sales item reducing the relative contribution of livestock sales. Conversely the areas more specialized in field crop sales in 1951 (grain and field crop types) have moved away from specialization to a more balanced crop - livestock system. (No claim can be made from the data that this reflects more integration at the farm level).

The special agriculture areas of 1951 have experienced rather disparate trends. In southeastern Essex the apparent trend has been to a more specialized horticultural emphasis due especially to very substantial increases in the value of greenhouse and nursery products. The Norfolk tobacco belt has remained areally very stable. This is hardly surprising given that acreage rights are allotted to producers and are transferable

only with the sale of the land and that the crop has rather specific soil needs. In the Niagara region the continuous horticultural zone has been broken and the relative place of tree and small fruits in sales has declined. These trends reflect urbanization, the relative increase in greenhouse and nursery product sales and the marked increase in the value of poultry and eggs in the area. A number of new areas emerge on the 1966 map where the sale of special crops (special agriculture) constituted over 50 percent of sales. One such area is within and adjacent to Metropolitan Toronto, where in some cases the absolute value of sales declined. In this area greenhouse and nursery products form the most significant commodity group. The townships of Flamborough E. (north of Hamilton) and Gwillimbury W. (Holland Marsh) emerge as general special agriculture areas, where greenhouse and nursery products and vegetables are respectively the most important commodities.

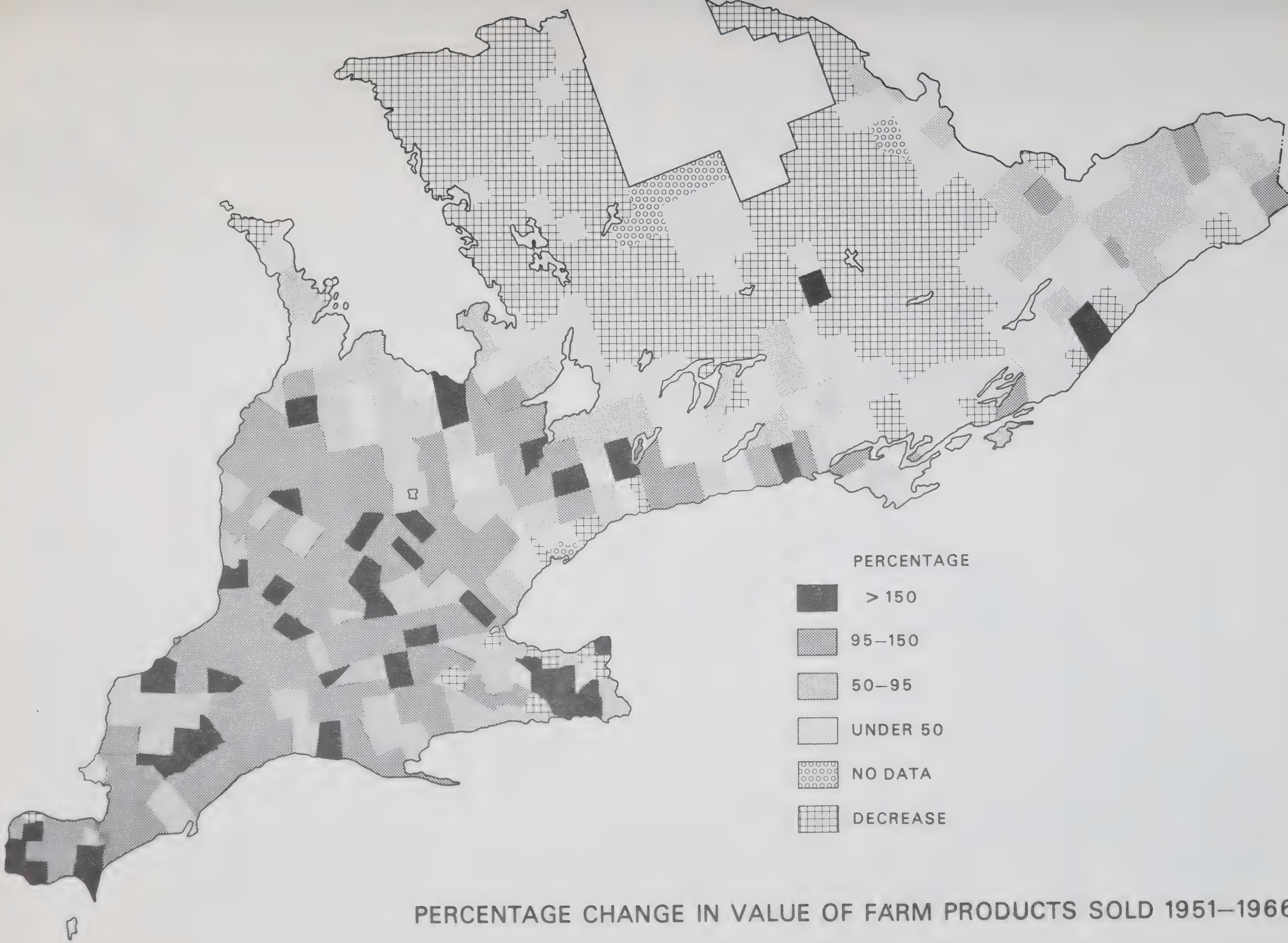
The foregoing provides a rather broad view of the spatial pattern of agriculture in Southern Ontario in 1951 and 1966 and of some of the changes that have occurred. It should be borne in mind that commodity sales are the sole basis of classification on Figures 24 and 25.

VALUE OF PRODUCTS SOLD

While the share contributed by the various commodities to gross sales remained remarkably stable from 1951 to 1966, the value of sales increased from 520 million dollars to 1015 million dollars or by some 95 percent. In part this increase in value of sales reflects inflation and in part real productivity gains.

Over the years from 1951 to 1966 Ontario agriculture has been subject to internal and external pressures resulting in change. One response of agriculture to the cost-price squeeze has been to produce more units of output per man and per acre. By so doing the operator aims to compensate for the smaller net return per unit of output resulting from the fact that the cost of inputs has increased faster than the value of output. The attempt by the farmer to meet this challenge has resulted in numerous changes in the last few decades. The enlargement of farms, the greatly increased acreages of grain corn and fodder corn at the expense of small grains and tame hay, the increased use of fertilizer, mechanization, herd improvement in dairy cattle, to mention a few, are all reflections of this response.

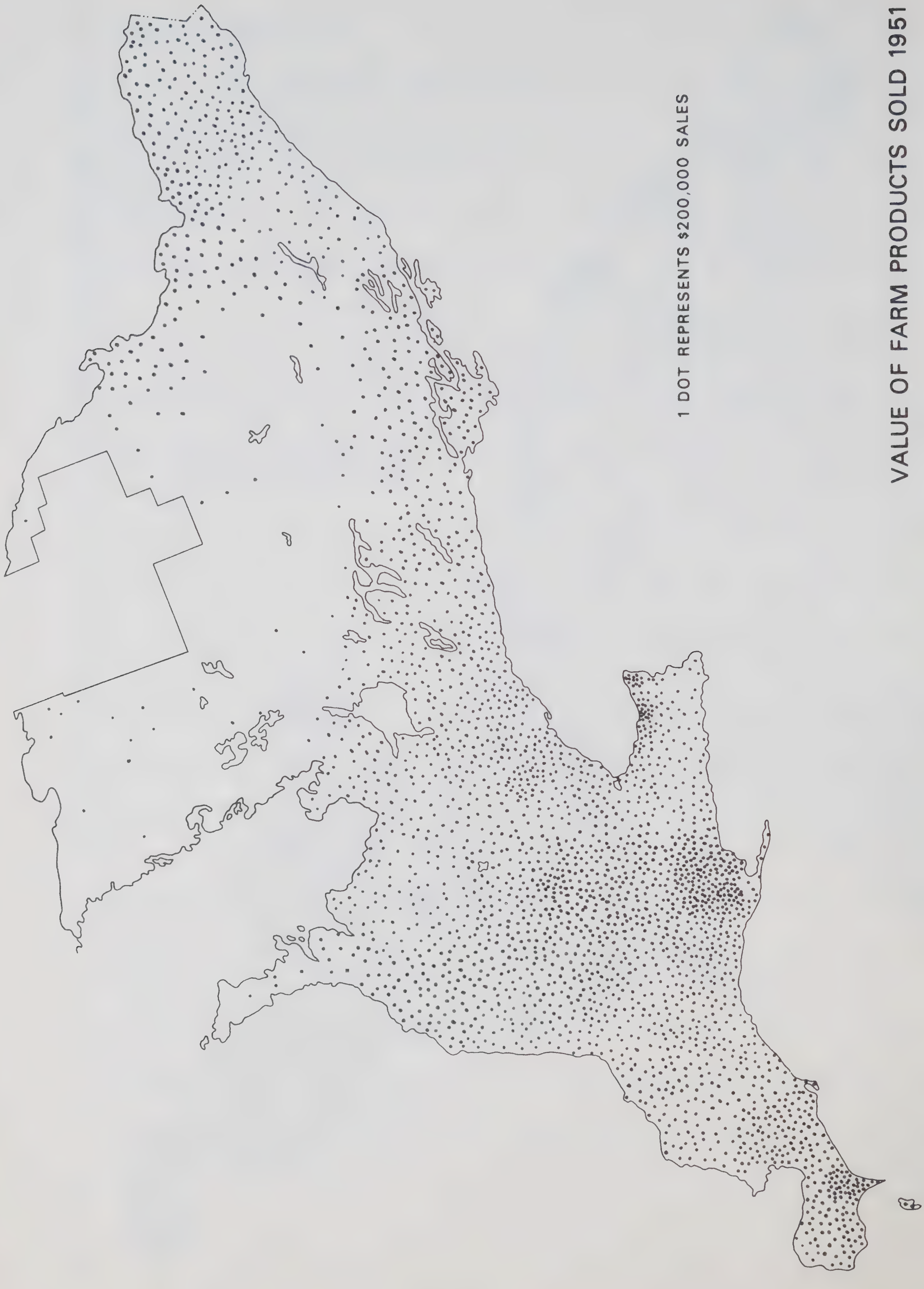
Township Data: One measurement of this response is in the increased value of sales. By mapping the value of sales and the changing value of sales, significant differences between areas are revealed. Figure 27 provides a visual representation of the distribution of sales in 1951. Apart from the low sales recorded for the shield area the most striking feature of the map is the relative spatial uniformity of sales. Only the special agriculture areas shown on Figure 24 stand out in terms of a somewhat increased density of dots.



PERCENTAGE CHANGE IN VALUE OF FARM PRODUCTS SOLD 1951–1966

26

27

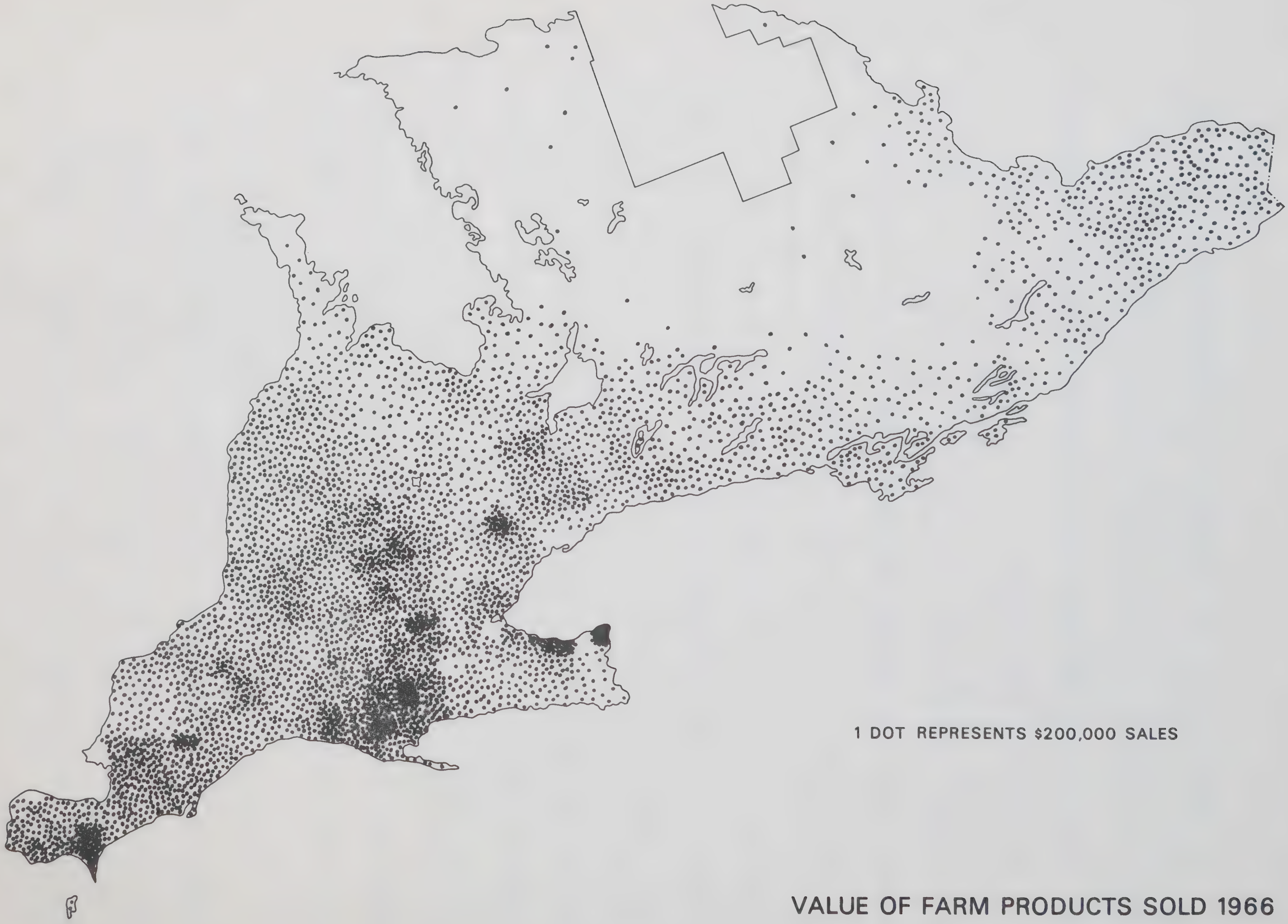


VALUE OF FARM PRODUCTS SOLD 1951
1 DOT REPRESENTS $200,000 SALES

Figure 28 shows the distribution of sales in 1966. On this map the impression of uniformity portrayed in 1951 is no longer evident. Not only do the special agriculture areas emerge quite strikingly but the area south of a line from about Toronto to Goderich emerges as distinctive from the rest of Southern Ontario.

Figure 26 shows the percentage change in the value of sales from 1951 to 1966. From this map it is possible to make some broad areal generalizations. (In townships coincidental with the Shield, sales had either declined or increased at rates well below average.) Eastern Ontario constitutes an area where, with few exceptions, the percentage increase has been well below average. A broad zone trending southeast from northern Bruce county across Grey and to Lake Ontario between Toronto and Trenton exhibits considerable variability but with few townships having increases much above average. To the south and west of this zone most townships recorded increases in sales above to well above average. In comparing Figure 28 with Figure 49 showing the percentage change in total inputs of non-land resources one finds a fair degree of correspondence despite the switch from a township to a county level of presentation. Differences in the percent change in total inputs of nonland resources by county can be satisfactorily generalized in line with the zones described above.

<u>Per-Farm Data</u>: On Figures 29 and 30 value of products sold is presented on a per farm basis. Figure 29 presents value of products sold per farm in 1951 by townships with a 2500 dollar range for categories. Townships with average sales per farm of under 2500 dollars are largely coincidental with the Shield, with a number of occurrences in eastern

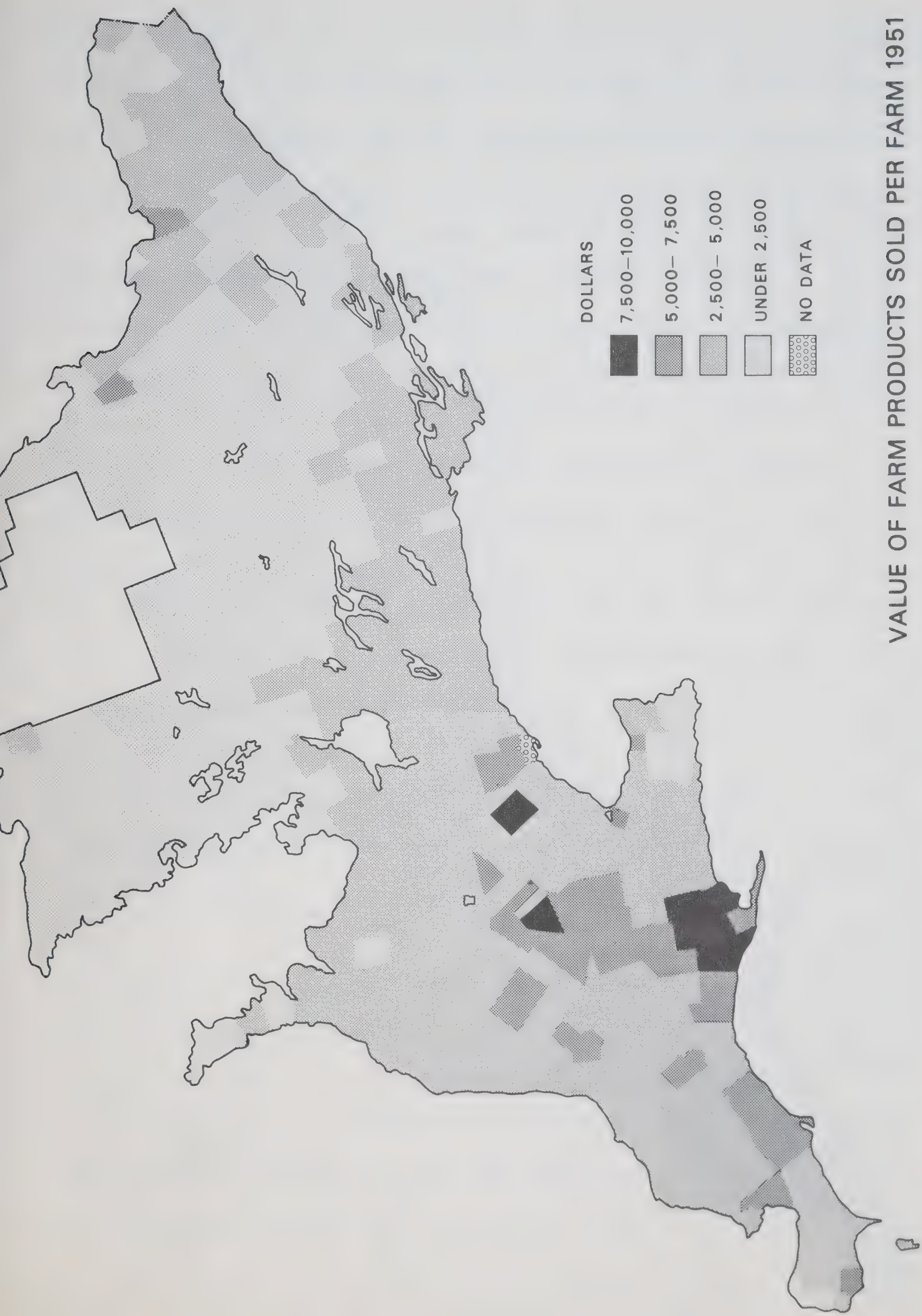


1 DOT REPRESENTS $200,000 SALES

VALUE OF FARM PRODUCTS SOLD 1966

28

29

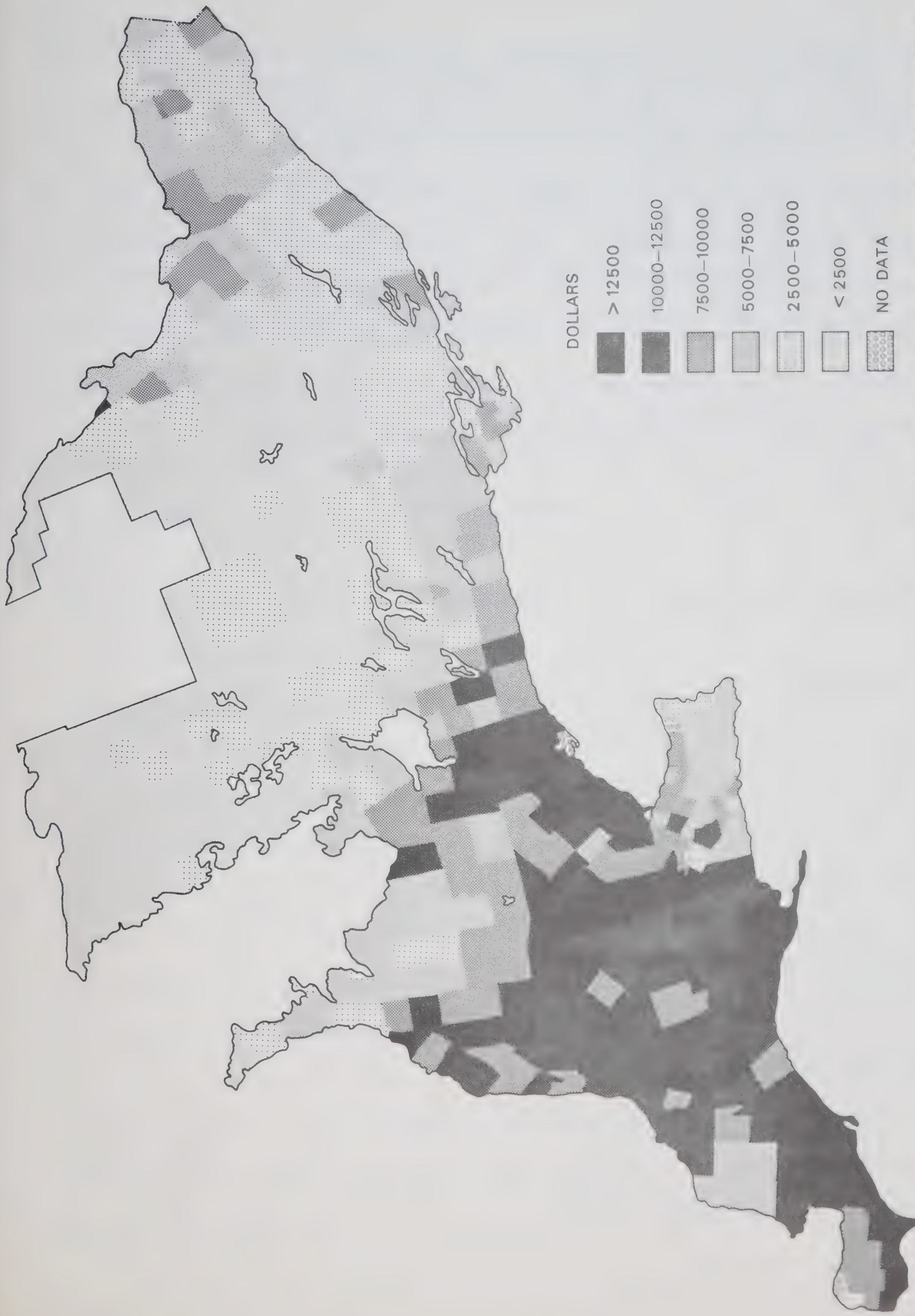


VALUE OF FARM PRODUCTS SOLD PER FARM 1951

Ontario and a handful of such townships to the southwest. Most townships record average sales per farm in the 2500 to 5000 dollar range. Nearly all townships with average farm sales from 5000 to 7500 dollars occur in the southwest while the core of the Norfolk tobacco belt records sales per farm in the 7,500 to 10,000 dollar range.

(In 1966 the picture is very different, reflecting not only the 95% increase in sales and the decline in number of farms but also the spatially unequal rates of change in the value of sales (Figure 30). Despite the great overall increase in sales and the decline in number of farms, townships in the Shield for the most part still recorded average sales per farm of under 2500 dollars. In eastern Ontario townships tended to stay in the same category or move up only one category. Thus in 1966 most townships had sales per farm either in the 2500 - 5000 range or the 5000 - 7500 range representing only a moderate change from 1951. In the area to the south and west of the Shield the contrast between 1951 and 1966 is dramatic. In 1951 only a few townships had average sales per farm over 7500 dollars and most had sales in the 2500 - 5000 dollar range. By 1966 the overwhelming majority have average sales per farm of over 7500 dollars while about half have average sales per farm in excess of 10,000 dollars.

It is difficult to state with any assurance how direct the relationship is between gross sales and net income from agriculture. The 1966 census of agriculture classifies farms with sales over 2500 dollars as commercial farms. With average sales in the Shield area under 2500 dollars obviously the majority of farms are non-commercial based on this criterion. To the extent the average sales per farm are a reasonable



VALUE OF FARM PRODUCTS SOLD PER FARM 1966

30

indicator of general farm prosperity, differences in Southern Ontario are striking. On a per farm basis by townships, the areal changes recorded from 1951 to 1966 bring out clearly that the response of agriculture has been far from uniform. Adjustments in farm income in the shield area have been far from adequate. Eastern Ontario has improved its average sales per farm but at a much slower rate than the southwest. Even in the area to the south and west of the Shield increases have not been uniform. In particular the Grey - Bruce area, the southern part of the Niagara peninsula and Lambton County have done less well.

SPECIALIZATION

Another response of agriculture to the cost-price squeeze and to the costs as well as the opportunities of technological change is to seek greater efficiency through specialization. Figures 24 and 25 reflect specialization areally, but only indirectly at the level of the individual operation. The system of classification used in the census of commercial farm classification by product type is too general to be of much utility.

Given that the share contributed by the various commodities to gross sales has remained remarkably stable from 1951 to 1966, greater specialization at the farm level should generally be reflected by two trends:

(a) a declining proportion of farmers participating in the production of a given commodity

(b) an increasing scale of participation by farmers in the production of that given commodity.

Table 31 presents data for all of Ontario related to the two trends postulated above. The data supports the trends suggested. For example one can observe that in 1951 some 71 percent of census farms reported milk cows compared with only 47 percent in 1966. On the other hand in 1951 only 1.1 percent of farms reporting milk cows reported 33 or more compared with 13 percent in 1966.

While increased specialization is obviously an important trend in Southern Ontario, it is unfortunately not possible to determine if the movement to more specialized operations is much more rapid in some areas than in others. If it is felt that a movement to greater specialization

TABLE 31

Data Supporting Farm Specialization, Ontario

A. % of census farms reporting:	1951	1956	1961	1966
cattle (all ages)	81	79	78	73
milk cows	71	68	60	47
pigs (all ages)	62	52	46	38
chickens (all ages)	69	62	50	33
wheat	36	33	29	18
corn for grain	13	19	16	21
soybeans	5	6	6	7
potatoes	43	33	28	25
vegetables	10	10	9	8

B. % of census farms reporting the particular commodity with:	1951	1956	1961	1966
cattle herd size 48+	5.5	11.9	20.5	29.3
milk cows 33+	1.1	2.5	6.0	13.0
pigs 48+	7.5	9.9	17.8	23.6
chickens 973+	2.7	4.0	6.2	7.5
wheat acreage 48+	1.5	1.9	3.8	4.1
corn acreage 48+	4.1	8.1	9.0	21.4
soybean acreage 33+	19.8	25.3	28.0	38.6
potato acreage 17.4+	.3	1.0	1.5	2.0
vegetable acreage 17.6+	N.D.	9.4	14.0	19.8

Source: calculated from Table 2 and Table 10,1966 Census of Canada, Agriculture, Ontario, Catalogue No. 96-607, D.B.S., Ottawa, 1968.

is of major significance to future viability, then further research is needed to identify the areas where adjustment in this direction is lagging.

PART-TIME FARMING

In Ontario, a substantial proportion of farmers are using part-time work off the farm to bridge the income gap between farming and non-farm employment. Such a phenomenon, it has been agreed, can serve two purposes: "it supplements the income of farm families, and it provides some of them with the essential first step towards full-time non-farm employment"[1]. It has also been stated that researchers often view farm adjustment processes in terms of absolutes; ie. the inclination is to emphasize the inefficiency of small-scale farming and to offer solutions based as "upward mobility to a viable size for a few and withdrawal for the rest. It is becoming increasingly clear, however that life is producing a third solution, or at least a third possibility which conceivably could be a solution: part-time farming"[2].

By necessity of definitional and data constraints the term "part-time farming" in this report is based on the D. B. S. definition of a part-time farmer. Hence, for example, the varying distribution of part-time farming across Ontario can only be presented by the distribution of part-time farmers[3]. Furthermore the nature of the data precludes specific analysis and explanation of part-time farming at this time. However, the relative importance of the phenomenon in Ontario agriculture, the spatial distribution of part-time farmers and the spatial distribution

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[1]The Challenge of Abundance, Special Committee on Farm Income: Ontario, Ontario Dept. of Agriculture and Food, January 1969, p. 129.

[2]Proceedings of the Canadian Agricultural Congress 1969, (Ottawa: Queens Printer 1969) p. 407.

[3]The D. B. S. definition of a part-time farmer is an operator of a census farm who earned more than $750 from sources off the farm and/ or who worked more than 75 days off the farm.

of intensity of off-farm work are presented for 1951 and 1966.

The part-time farming phenomenon appears well entrenched in the agricultural sector of Ontario's economy. Utilizing the current census definition of, and information pertaining to, part-time farm operations,[1] one can briefly note the importance of this phenomenon on the basis of certain selected statistics.

Importance of Part-time Farming

In 1966 (the most recent census period for which published information is available) there were nearly 110,000 farm operators in Ontario[2] of whom nearly 39,000 or about 35 percent, were classified as part-time. Farms operated by part-time operators embraced approximately 3.2 million acres or about 30 percent of the total farm area of Ontario. Furthermore, about 3.3 million acres, or nearly 28 percent of all the improved land and about 2.3 million acres, or over 27 percent of all the cropland in the province existed on farms operated by part-time farmers. Similar proportions are evident when one considers certain economic measures. For example, total capital value of "part-time" operations (including livestock and poultry inventory, equipment, land and buildings) amounted to almost 1.4 billion dollars or over 28 percent of the total value for all farms, while the contribution by part-time farmers to the value of agricultural products sold reached nearly 220 million dollars which represented over 21 percent of the total

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[1]A part-time operator is defined as a "census farm operator reporting income from agricultural and non-agricultural work off the operator-farm of $750 or more <u>or</u> who worked 75 days or more off the farm during the past 12 months", <u>Census of Canada</u>, <u>Agriculture Ontario</u> Vol. IV, 1966, p. IX.

[2]Because cross-tabulated census material pertaining to part-time operators is published only on a Provincial basis, the discussion here applies to the whole of Ontario.

gross sales from all farms in the province. Part-time farmers also contributed substantially to the total taxes collected from the assessment on land and buildings, by paying approximately 12 million dollars or over 28 percent of the total farm taxes in Ontario, and to the cash wages paid to farm labour by paying over 18 million dollars, or nearly 20 percent, of the total cash wage labour costs on Ontario farms in 1966. Table 32 presents a summary of the absolute and relative values of the selected measures described above which indicates in a general way the importance of the part-time farmer in the agricultural scene in Ontario.

Additional evidence of the impact of the part-time farmer exists in the fact that the incidence of work off the farm occurs in every gross farm sales class published in the census. Thus, from Figure 31, one can note that although part-time farmers are most prevalent in the small-farm sectors (ie. part-time farmers operate over 54 percent of all farms with gross sales of less than $2,500) they also comprise nearly 20 percent of the top sales category farms (i.e. gross sales over $35,000 per year). Moreover, by expressing in each sales category the percentage of part-time and full-time farmers of their respective totals in Ontario, one can note a similar ratio between these percentages for all gross sales classes from $5,000 to over $35,000. In each of these sales categories there occur fewer part-time than full-time farmers as a proportion of their respective totals (see Figure 32). However, for all sales classes below $3,750-$4,900 the part-time element becomes increasingly more entrenched with the result that one out of every two part-time farmers reports gross farm sales of less than $2,500 while only one out of four full-time farmers is in this category. Table 33 summarizes the distribution of farms, operated by part-time and full-time farmers, by value of products sold.

TABLE 32

Comparative Statistics for Part-time and Full-time Farm Operations, Ontario, 1966

		Part-time as % of Ontario Total
Number of Part-time Operators	38,792	35.3
Number of Full-time Operators	71,905	
Total Farm Operators	109,887	
Farm Area Operated by P.T. Operators	5,248,656	29.4
Total Farm Area (acres)	17,826,045	
Acres of Improved Land Operated by P.T. Operators	3,332,455	27.8
Total Acres of Improved Land	12,004,305	
Acres of Cropland Operated by P.T. Operators	2,295,047	27.5
Total Acres of Cropland	8,358,741	
Capital Value of P.T. Operations	$1,377,218,100	28.2
Total Capital Value	$4,884,129,600	
Value of Agricultural Products Sold by P.T. Operators	$219,595,690	21.2
Total Value of Products Sold	$1,035,338,920	
Farm Taxes Paid by P.T. Operators	$11,857,240	28.3
Total Farm Taxes	$41,808,940	
Cash Wages Paid by P.T. Operators	$18,083,880	19.9
Total Cash Wages Paid to Farm Labour	$91,030,050	

Source: Compiled from Census of Canada, Agriculture in Ontario, 1966, Vol. IV.

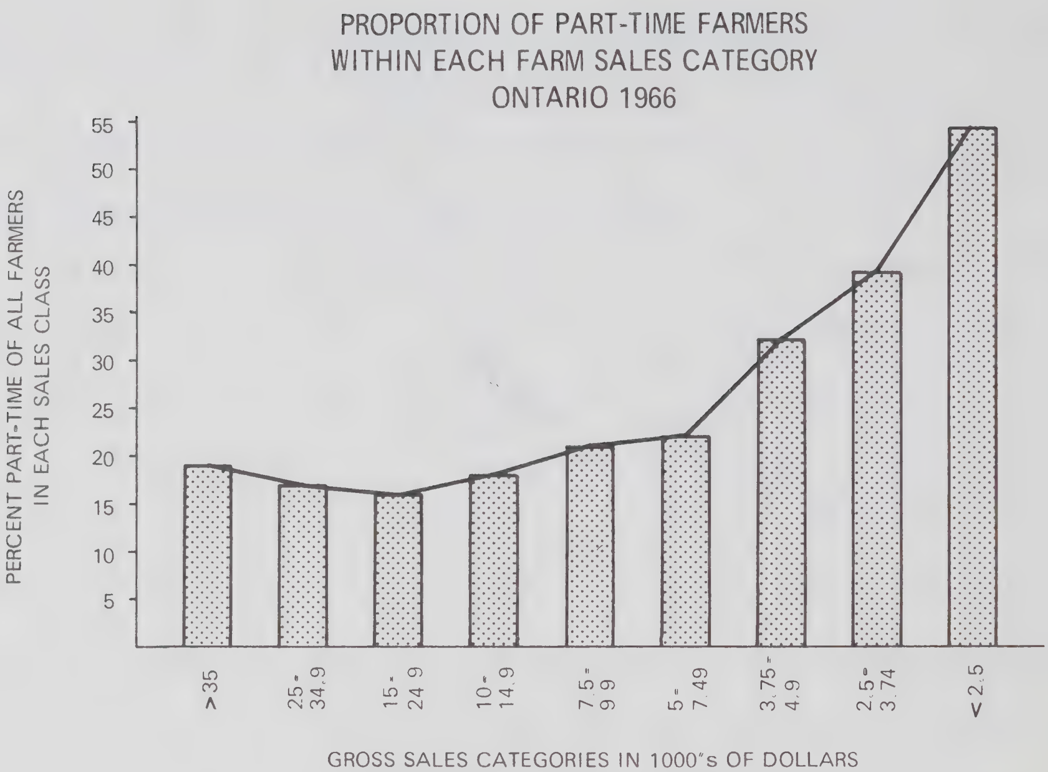
PROPORTION OF PART-TIME FARMERS
WITHIN EACH FARM SALES CATEGORY
ONTARIO 1966
PERCENT PART-TIME OF ALL FARMERS
IN EACH SALES CLASS
55
50
45
40
35
30
25
20
15
10
5
>35
25 - 34.9
15 - 24.9
10 - 14.9
7.5 - 9.9
5 - 7.49
3.75 - 4.9
2.5 - 3.74
< 2.5
GROSS SALES CATEGORIES IN 1000's OF DOLLARS

Fig. 31

DISTRIBUTION BY SALES CATEGORIES OF TOTAL NUMBER OF PART-TIME AND FULL-TIME FARMERS, ONTARIO, 1966.

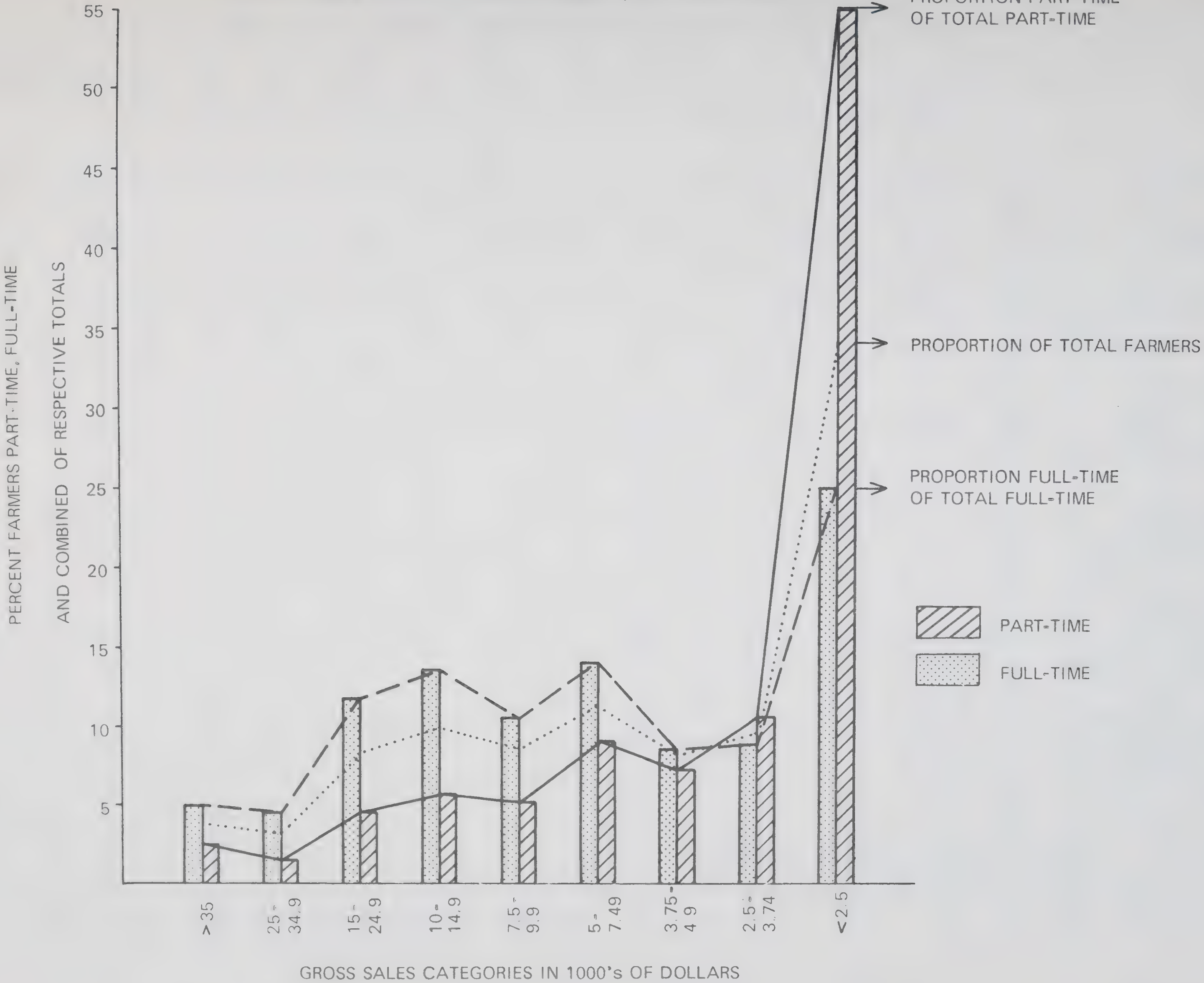

Fig. 32

TABLE 33

Distribution of Farms Operated by Part-time and Full-time Operators by Value of Products Sold, 1966

	Value of Agricultural Products Sold in 1000's of Dollars								
Value Class	>35	25-34.9	15-24.9	10-14.9	7.5-9.9	5-7.49	3.75-4.9	2.5-3.74	<2.5
All Farms	4,385	3,733	9,692	11,522	9,210	13,173	8,489	10,520	39,081
No. Part-time	855	652	1,613	2,091	1,932	3,527	2,739	4,096	21,287
No. Full-time	3,530	3,081	8,079	9,431	7,278	9,646	5,750	6,424	17,794
% Part-time of All Farms in each Class	19.5	17.5	16.6	18.1	21.0	26.8	32.2	39.0	54.5
% Part-time of Total Ont. Part-time Farms	2.2	1.7	4.2	5.4	5.0	9.1	7.1	10.6	54.9
% Full-time of Total Ont. Full-time Farms	5.0	4.3	11.4	13.3	10.2	13.6	8.1	9.0	25.0
% Part-time and Full-time of Total Ontario Farms	3.9	3.5	8.8	10.6	8.5	11.9	7.7	9.6	35.4

Total Farms (1966) = 109,887
Total Part-time Farms = 38,792

Source: Compiled from Canada Census, Agriculture in Ontario 1966, Vol. IV, Table 37 and 23.

The Distribution of Part-time Farmers, 1951 and 1966

During the past twenty-five years that portion of the farm sector represented by the rural farm population, number of farms and number of farm operators has declined in Ontario. From 1951 to 1966 the number of census farms declined by over 40,000 or about 27 percent, while rural farm population numbers decreased by nearly 300,000 (rural farm population represented 14.7 percent of the total Ontario population in 1951, but only 6.9 percent in 1966). Accompanying these absolute and relative declines has been an increase in the number of farm operators reporting off-farm work.[1]

In 1951, nearly 40,000 (or about 27 percent) of Ontario farmers reported off-farm work. By 1966 this number had increased to over 45,000 (or about 41 percent of all farm operators in Ontario). Analysis has indicated that the part-time farming phenomenon is not evenly distributed throughout Southern Ontario and that concentrations of farmers reporting off-farm work occur.

In 1951 high concentrations of part-time farmers (ie. townships with over 50 percent of farm operators reporting off-farm work) were evident in the shield area, portions of the Niagara Peninsula (especially Welland County) and in one township of Essex County. Above average concentrations occurred in the "Golden Horseshoe" region (including the Kitchener - Guelph area) and throughout most of Essex County. Most of the townships of the remainder of Southern Ontario portrayed concentrations of less than 20 percent of operators reporting off-farm work.

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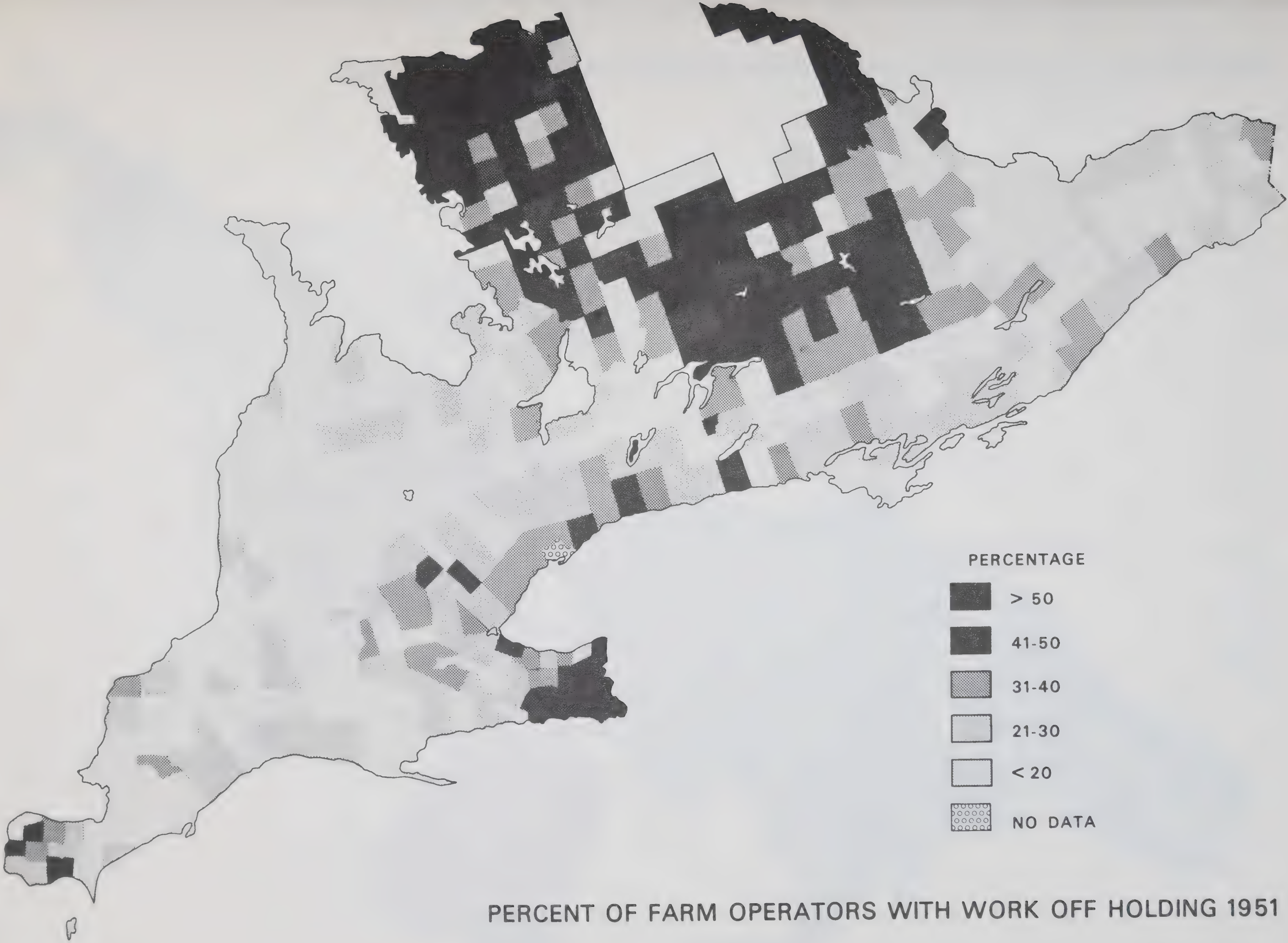
[1]Because no census definition of a "part-time" farmer was established in the 1951 census, the reference to part-time farmers throughout this section will be to the number of farm operators reporting off-farm work.

Figure 33 presents the spatial distribution on a township basis of the concentrations of part-time farmers.

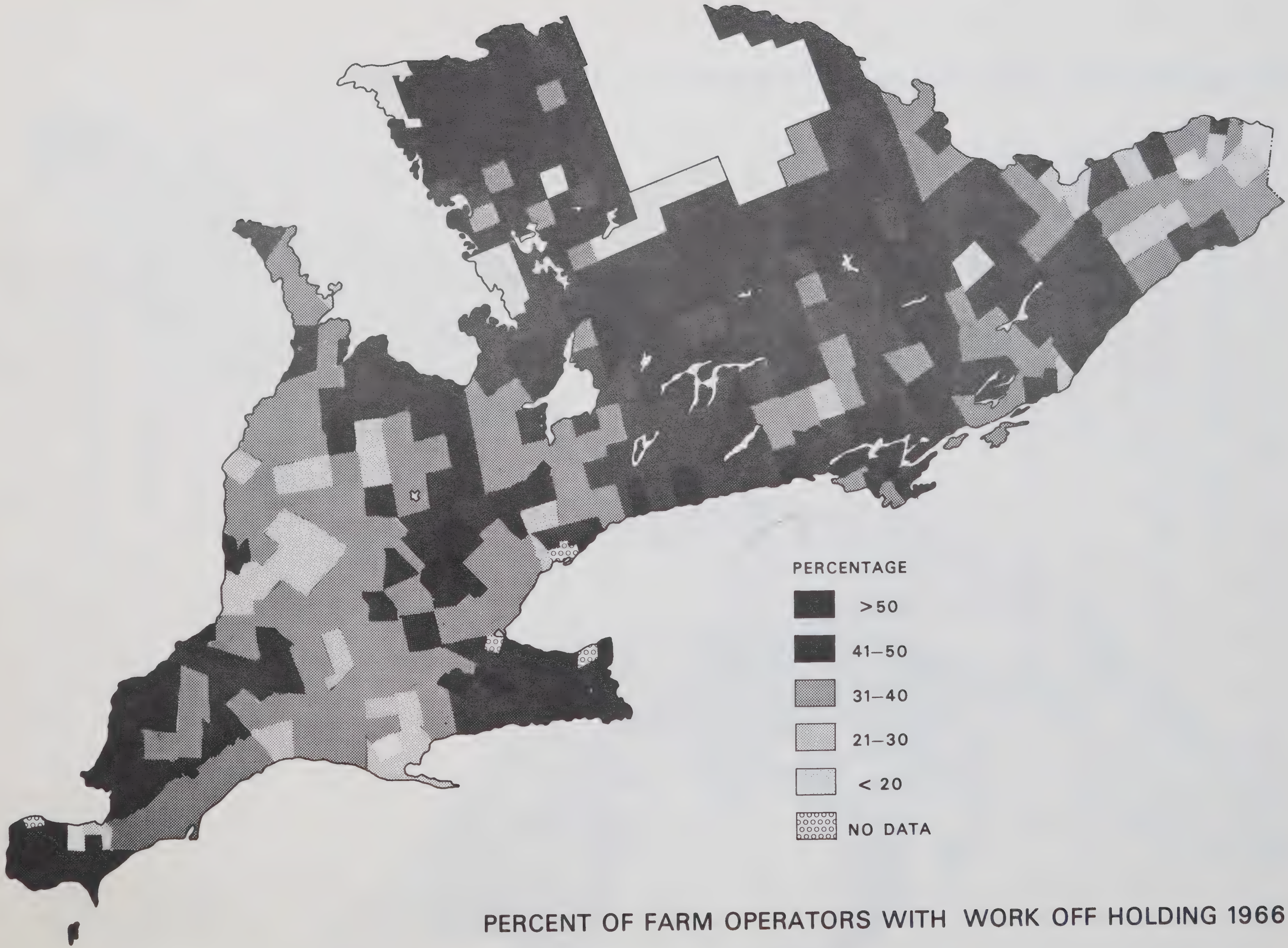
By 1966 the part-time farmer had become well established in all townships of Southern Ontario. As indicated by Figure 34 the main areas of concentration are still centred on the Shield, the Niagara Peninsula, the "Golden Horseshoe" and Essex County. However, above average proportions of farmers reporting off-farm work now exist in Lambton County, the southern Georgia Bay area and in most of the townships north-east of Toronto. This intensification of the number of farmers combining farming with some type of off-farm work can be summarized in graph form. Figure 35 portrays the fact that during 1951 in 45 percent of the 466 townships under study less than 20 percent of the farmers engaged in off-farm work, while in only 10 percent of all townships did the incidence of part-time farming exceed the 50 percent level. The situation changed dramatically by 1966 when in only 1.5 percent of all townships did the incidence of part-time work not exceed the 20 percent level. Indeed in 25 percent of all townships over 50 percent of the operators were part-time farmers. Furthermore in nearly 60 percent of all townships the rates of part-time farming were 41 percent or higher. Clearly, an ever increasing segment of farm operators pressured by the cost-price squeeze are responding by attempts to supplement their farm income from off-the-farm sources.

Although the previous measure indicated the proportion of farmers engaged in off-farm work, it failed to specify the degree of commitment to nonfarm employment. Hence the average number of days of off-farm work per farm reporting off-farm work was calculated for each township for 1951 and 1966. Such a simple index is a useful indicator of the intensity of off-farm work.



PERCENT OF FARM OPERATORS WITH WORK OFF HOLDING 1951

33



PERCENT OF FARM OPERATORS WITH WORK OFF HOLDING 1966

34

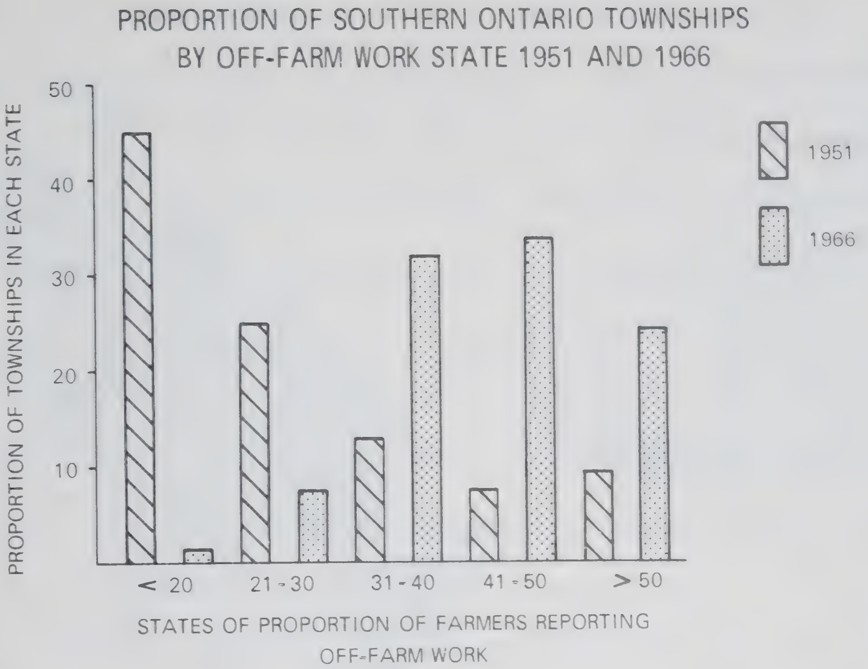

PROPORTION OF SOUTHERN ONTARIO TOWNSHIPS
BY OFF-FARM WORK STATE 1951 AND 1966
PROPORTION OF TOWNSHIPS IN EACH STATE
50
40
30
20
10
1951
1966
< 20
21 - 30
31 - 40
41 - 50
> 50
STATES OF PROPORTION OF FARMERS REPORTING
OFF-FARM WORK

Fig. 35

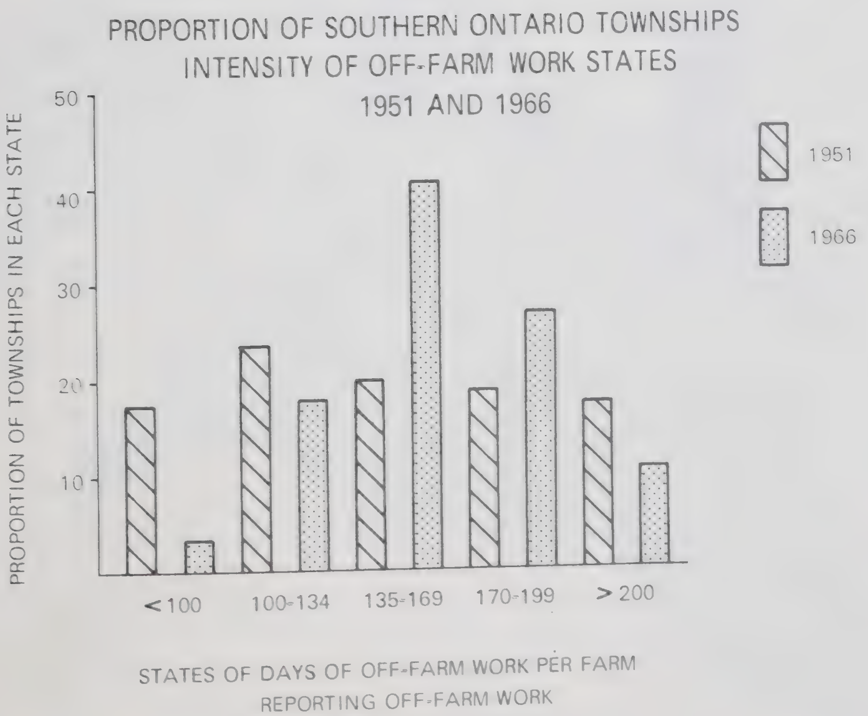
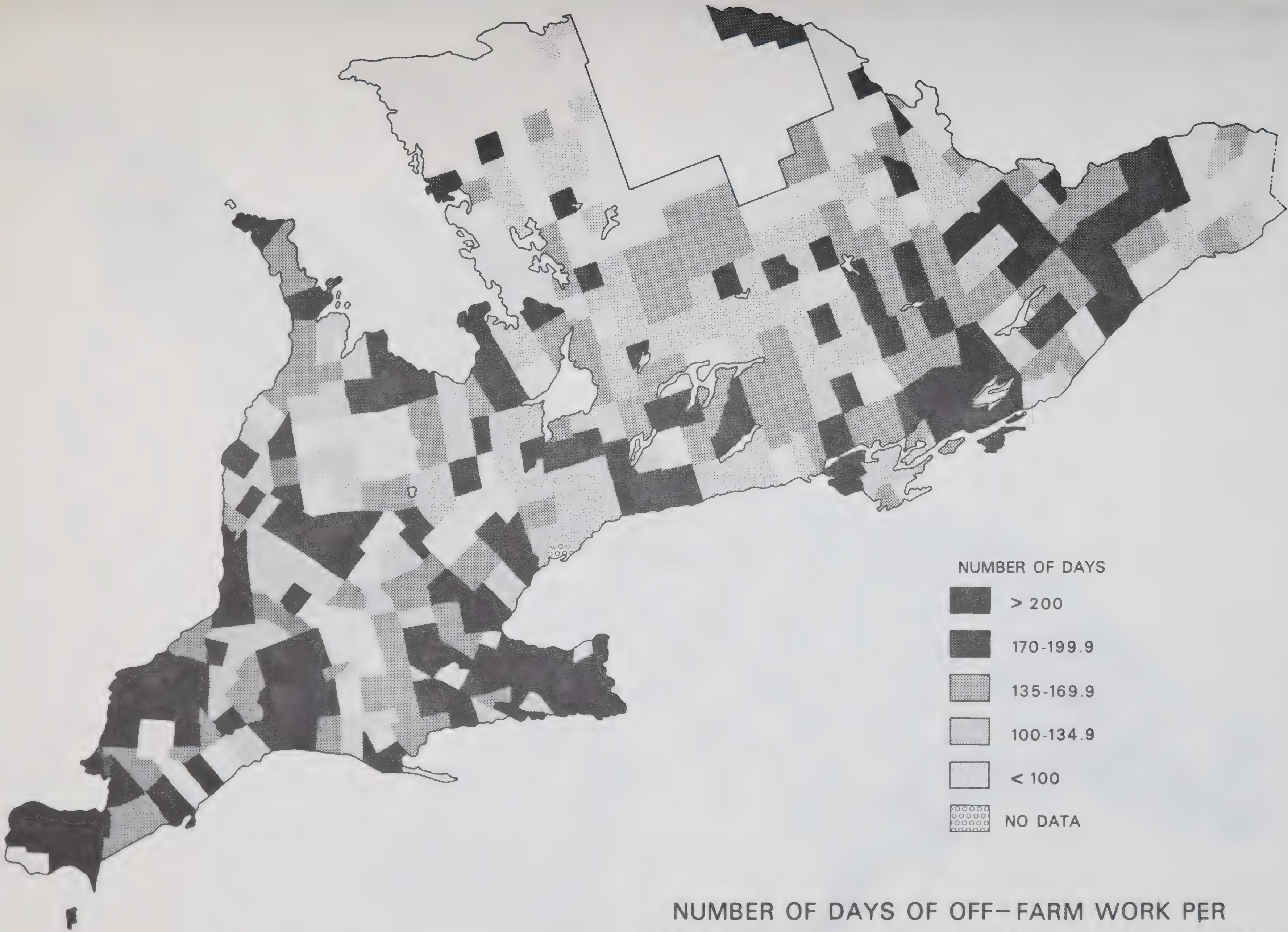

PROPORTION OF SOUTHERN ONTARIO TOWNSHIPS
INTENSITY OF OFF-FARM WORK STATES
1951 AND 1966
PROPORTION OF TOWNSHIPS IN EACH STATE
50
40
30
20
10
1951
1966
< 100
100-134
135-169
170-199
> 200
STATES OF DAYS OF OFF-FARM WORK PER FARM
REPORTING OFF-FARM WORK

Fig. 36

In 1951 no discernable spatial pattern among classes of intensity of off-farm work existed. Furthermore, the proportion of townships in each state, a category of intensity, was very similar as indicated by the graph presented: Figure 36. The highest rates of off-farm commitment (ie. 200 or more days per year per farm) did, however, appear in Essex and Lambton Counties, the London area, the Niagara Peninsula and the Kingston area (Figure 37). By 1966 a clearer pattern had emerged. High degrees of off-farm work commitment existed in the townships in proximity to all the major urban centres of Southern Ontario (Figure 38). At this stage the process of intensification of off-farm work appears to be related directly with the job opportunities generated by the larger urban centres. The farmers in these townships undoubtedly perceive the opportunity to increase total earnings and respond to the "pull" of the city. In these townships there also occur certain factors, such as high land values, high non-land capital inputs and the "air of anticipation" of impending urbanization, which tend to "push" the farmer into situations which require him to supplement farm income with off-farm work. It is difficult, however, to state valid explanations, at the macro-scale of analysis, about the distribution and intensity of part-time farming. The phenomenon is the result of individual decision making based on the perception of and the response to varying situations. At best only broad patterns and general associations of part-time farming can be presented here.

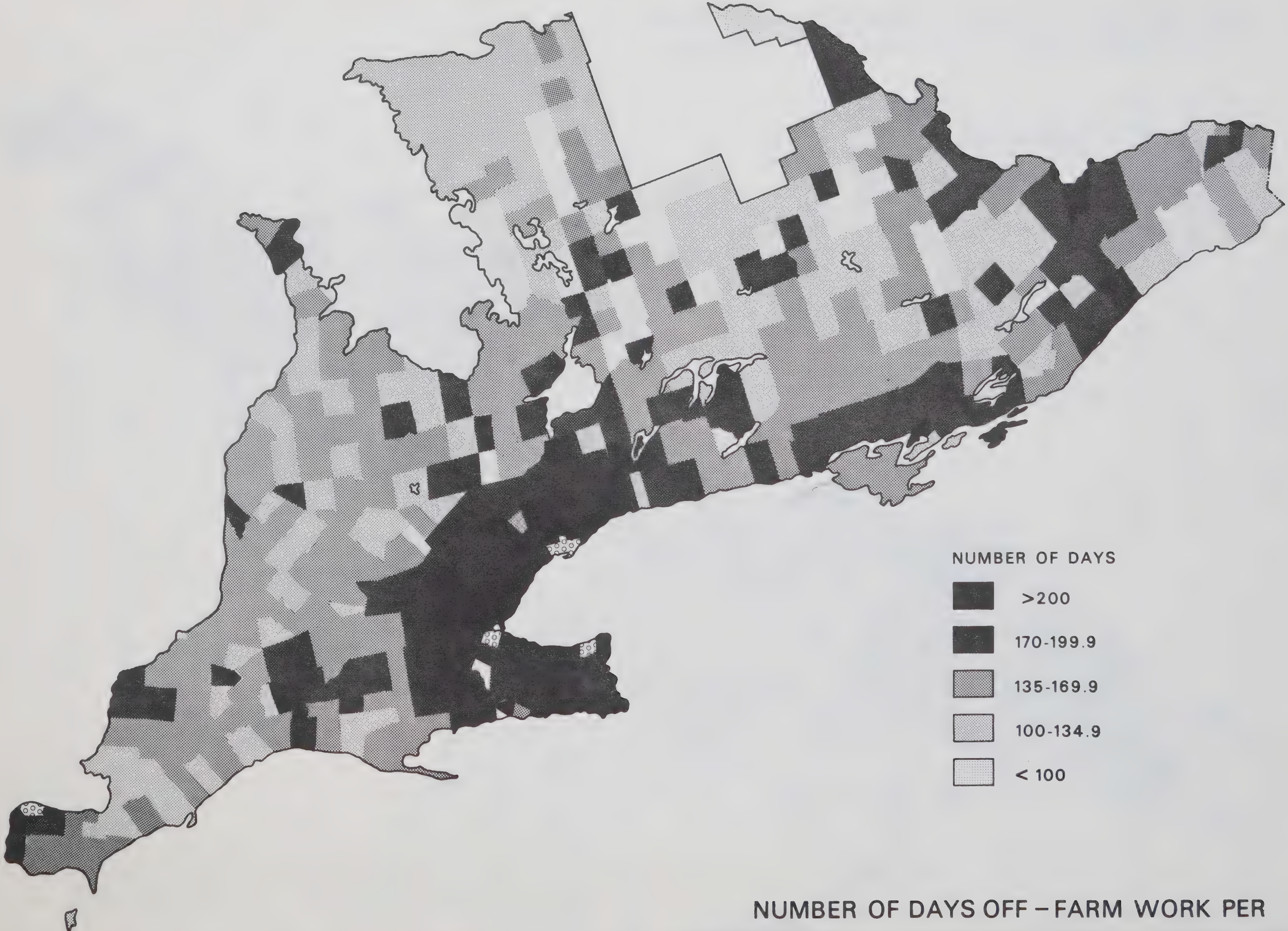
The main conclusions to be noted are as follows:

1) the absolute and relative numbers of part-time farmers has increased from 27 percent of all farms in 1951 to 41 percent in 1966. The phenomenon is well entrenched in the agricultural economy of Southern



NUMBER OF DAYS OF OFF–FARM WORK PER FARM REPORTING WORK OFF FARM HOLDING 1951

37



NUMBER OF DAYS OFF – FARM WORK PER
FARM REPORTING WORK OFF FARM HOLDING 1966

CUMULATIVE PROPORTIONS OF PART-TIME AND FULL-TIME FARMERS BY INCREASING SALES CATEGORY SOUTHERN ONTARIO 1966

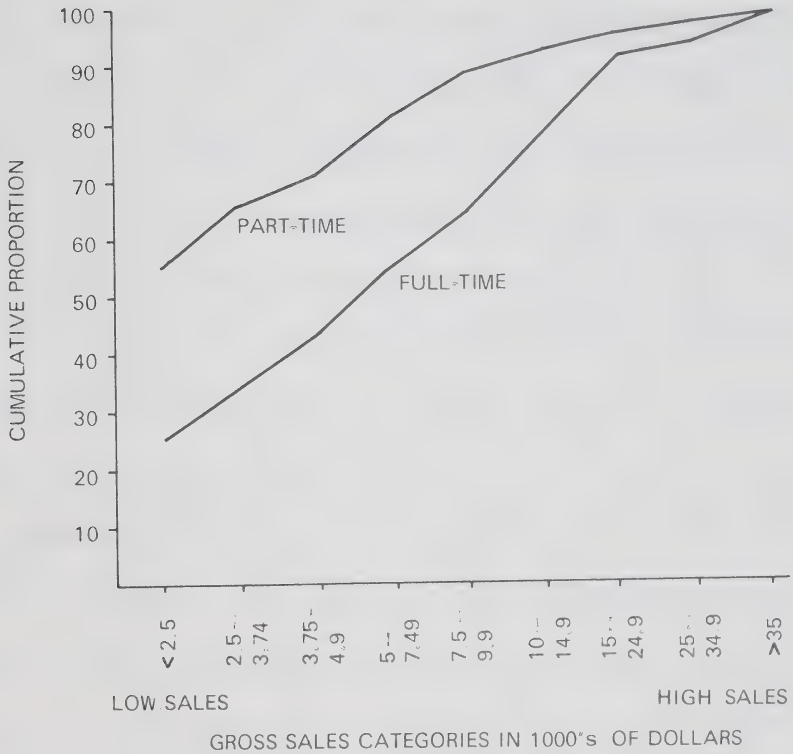


Fig. 39

Ontario and many farmers are using work off the farm to supplement declining farm incomes. It further appears as though part-time farming has become and probably will remain a permanent feature of Ontario agriculture.

2) Part-time farmers are not uniformly distributed throughout Southern Ontario. Concentrations occur in the shield areas and around the major urban centres. However, in spite of the fact that a high proportion of the Shield farmers are part-time, the off-farm work intensity is very low (100 or fewer days per farm per year). Thus in the marginal areas of Southern Ontario where the physical and economic opportunities for farming are low, the farmers can supplement meagre farm incomes only through sporadic off-farm work.

3) Part-time farmers embrace nearly one-third of Ontario's farmland, yet contribute only about 20% to the total agricultural output. Indeed the greater majority of part-time farmers (55 percent) experienced gross sales of $2500 or less in 1966. (Figure 39 indicates the cumulative proportions of part-time and full-time farmers by sales categories). What the regional implications are of this fact is difficult to ascertain without specific data on the amount of land (improved and unimproved) held by part-time farmers, and the contribution to agricultural production by part-time farmers within each township.

4) As a form of the rural adjustment process part-time farming appears as a logical solution for low farm income farmers and attempts should be made to provide job opportunities of a more permanent nature in the marginal areas of southern Ontario.

CHANGE IN FARM SIZE

A positive response to a deteriorating farmer-income situation may often be expressed in the form of expansion of farm acreage. Agricultural land holdings may be consolidated through the purchase of neighbouring or nearby fields or even whole farms, or through leasing. The motivation for increasing farm size can be explained in at least two ways. On the one hand, the resulting increase in the ratio of the land resource to the management unit can improve the return to the latter, especially if it was previously underutilized. The same, of course, can apply in the case of farm machinery, buildings, and other assets characterized by technical indivisibility of their productive capacity. On the other hand, a larger land base for a farm will also increase (over previous levels) the flexibility of farming operations with respect to the distribution of activities over space, and at the same time permit greater diversification in farming.

The potential utilization of unused productive capacity is the principal source of advantage that can be created in both of the above explanatory contexts. In the first case the unused capacity is associated with fixed and lumpy costs of productive factors; in the second, with complementary costs arising from product diversification.

An indication of the degree to which the process of farm consolidation has occurred in different parts of Southern Ontario since 1951 can be gained from Census of Agriculture data--specifically, from the comparison over time of the average size of census farms. This section attempts such a comparison at the level of the county.

Census data on farm-size change were purified by eliminating,

to the extent possible, farms with apparent noncommercial characteristics. In this regard, census farms which reported less than 10 acres of improved land were not counted[1]. Because the total land area of such farms is not given in Census tables, it was necessary to make an appropriate assumption. This was that the average size of census farms reporting less than 3 acres improved land is 10 acres; and from 3 to 9 acres improved, 20 acres[2].

Details of percentage change (increase) in the average size of farms (as defined) for each of 42 counties in Southern Ontario over the 15-year period 1951-1966 are given in Table 34. The change in average farm size is also mapped--Figure 40. It can be calculated that 12 of the 17 counties exhibiting percentage change greater than 19.5% are found from Cobourg (Northumberland County) toward the north-east. The ten counties ranked lowest in terms of percentage increase are located in an arc around Toronto, from Lincoln County in the south round to Durham and Peterborough Counties in the east--Figure 40.

It is worth noting that in the 12 "N-E" counties the average size of farms with 10 acres and over improved was already greater in 1951 than was the case in the 10 "Arc" counties. The difference had increased substantially by 1966, as is indicated immediately below.

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[1] It may be argued that failure to include this class of farm removes from consideration an important group of "specialty" farms engaged in the intensive production of poultry, nursery, and greenhouse products, etc. We do not disagree. Our objective here, however, is to examine farm response in situations where land (rather than situs) represents an important variable in production decisions.

[2] This assumption was subsequently changed, to: For a given county, the average size of farms reporting less than 10 acres of improved land equals the average acreage of all farms in that county in size classes below that class showing the greatest number of farms. The change did not materially affect the findings of the analysis.

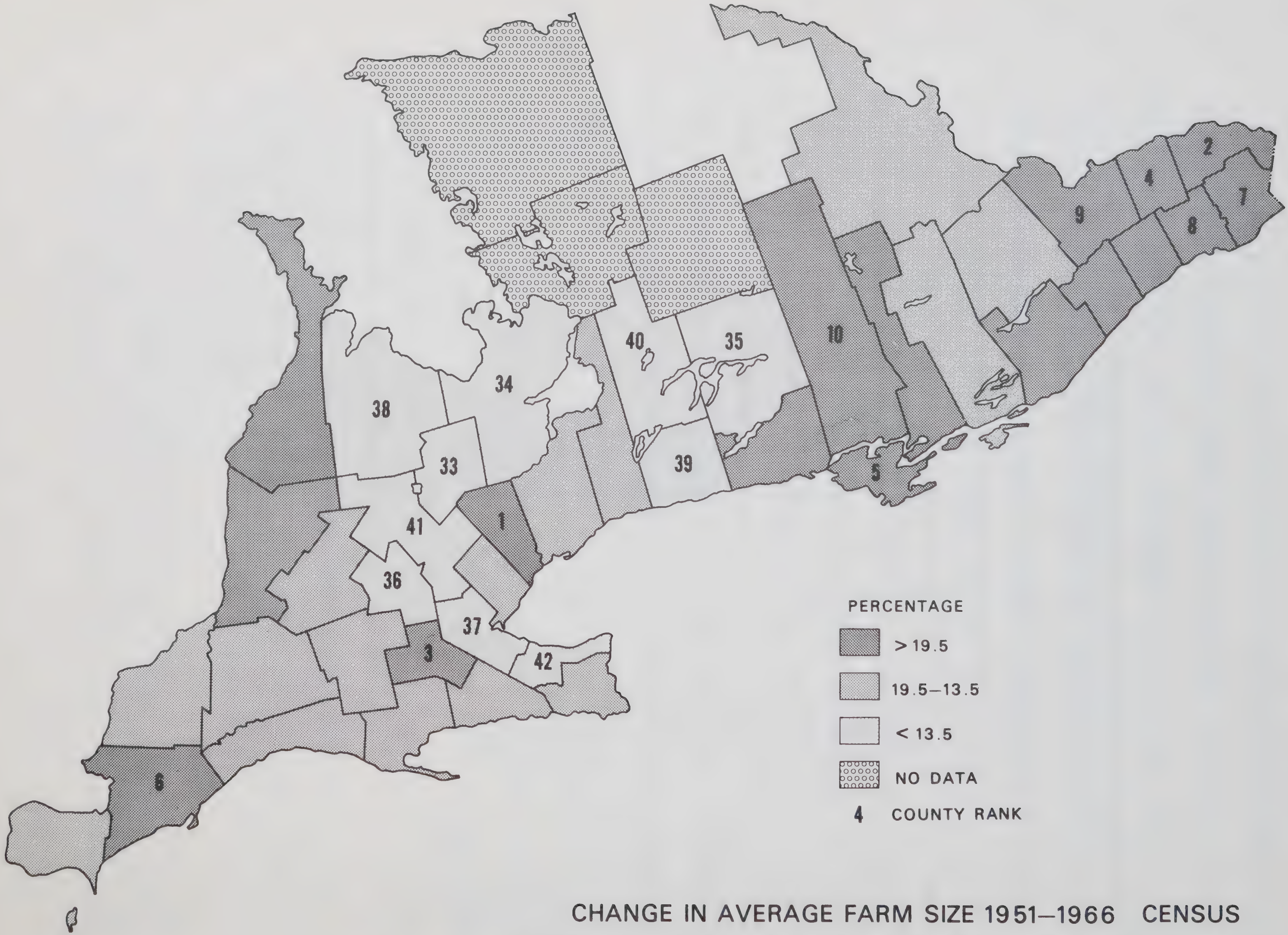
TABLE 34

Increase in Average Size of Farms Reporting 10 Acres and Over Improved, 42 Counties of Southern Ontario: 1951-1966

County	Increase[1] %	Rank[2]	County	Increase[1] %	Rank[2]
Brant	30.5	3	Lincoln	6.4	42
Bruce	22.8	12	Middlesex	17.7	
Carleton	24.3	9	Norfolk	14.0	
Dufferin	13.6	33	Northumberland	21.1	14
Dundas	20.3	15	Ontario	15.9	
Durham	10.7	39	Oxford	13.8	
Elgin	19.0		Peel	32.2	1
Essex	18.3		Perth	14.5	
Frontenac	14.4		Peterborough	12.7	35
Glengarry	26.3	7	Prescott	30.7	2
Grenville	20.2	16	Prince Edward	29.1	5
Grey	11.3	38	Renfrew	14.4	
Haldimand	19.1		Russell	29.2	4
Halton	15.4		Simcoe	13.0	34
Hastings	24.0	10	Stormont	25.1	8
Huron	21.5	13	Victoria	10.3	40
Kent	28.6	6	Waterloo	12.2	36
Lambton	13.7		Welland	14.6	
Lanark	17.1		Wellington	9.7	41
Leeds	19.7	17	Wentworth	11.4	37
Lennox and Addington	23.7	11	York	19.4	

[1]As percentage of 1951 average acreage for the county

[2]Ranking is higher when percentage increase is greater



CHANGE IN AVERAGE FARM SIZE 1951–1966 CENSUS
FARMS REPORTING 10 ACRES AND MORE OF IMPROVED LAND

Farms Reporting 10 Acres and Over Improved			
		12 "N-E" counties	10 "Arc" counties
		(acres)	
Average Size:	1951	155.0	142.7
:	1966	191.2	159.0

Much the same picture applies for change in average farm size over the shorter period 1951-1961. The counties generally showing greatest percentage farm-size change again occur to the north-east of Toronto, while those showing the least are found in the same arc ringing Toronto.

It is possible to find different meanings behind the results. For example, various aspects of the greater increase in average farm size for the "N-E" counties could be explained by some of the following "regional" characteristics that might apply to this group:

1. a relatively low cost of farmland
2. a greater number of farms offered for sale
3. a proportionately greater reduction in the number of farms, given the diminished acreage farmed
4. a proportionately smaller reduction in acreage farmed, given the fewer number of farms remaining
5. some combination of reduced number and reduced acreage.

Inspection of available data indicated that the percentage of census-farm acreage (census farms reporting 10 acres and over improved land) retired from agriculture between 1951 and 1966 was approximately equal for "N-E" and "Arc" groups of counties[1]. There was, however, a considerable difference between the two groups if the rate of retirement is expressed in terms of percentage change in the number of farms. For the N-E group of counties, the reduction between 1951 and 1966 was approximately 30 percent of 1951 numbers. The corresponding percentage for the "Arc" counties was 20 percent.

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[1]The respective percentages are 13.2 and 11.9.

We may, therefore, conclude that the explanation of difference in the change of farm size over the period 1951-1966 between the two groups of counties rests with a different level of reduction in farm numbers and not with the level of reduction in the aggregate acreage of census farms, to the extent that farm numbers and acreage are independent explanatory variables.

We might reasonably postulate that a one-to-one relationship holds between acreage reduction in aggregate and the associated reduction in farm numbers when both are expressed as percentages. Given such a relationship but at the same time the existence of a reduction in farm numbers not explained by acreage reduction, different percentage change in farm numbers is a reflection of different degrees of farm consolidation. Thus, the conclusion given in the paragraph immediately preceding might be expressed in the following form:

> The explanation of difference in the percentage increase in average farm size between the two specified groups of counties over the period 1951-1966 lies in different degrees to which the consolidation of farms has proceeded.

Finally, we note from Table 34 that Peel County from among all 42 counties considered ranked first in farm size increase over the period 1951-1966. Investigation indicated that explanation again lay with farm numbers and not with an aggregate acreage factor[1]. In the case of Peel County, however, inexpensive land could not have motivated or facilitated farm consolidation. Instead, land assembly associated with the upgrading of Malton Airport and for other urban development purposes could have been the main causative factor.

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[1]Farm-acreage reduction for Peel County amounted to 20.9 percent of the 1951 level, but farm numbers over the same time period declined more than 40% (compared to 30% for "N-E" and 20% for "Arc" counties).

PRICE AND PRODUCTION QUANTITY INTERRELATIONSHIPS

Agricultural Marketings and Price Interrelationships

A common presumption is that the quantities of agricultural products marketed and the prices received for them are inversely related. That is to say, an index of agricultural prices is high when the levels of production are low, and vice versa. In this section we examine evidence that supports or refutes this hypothesis as it relates to aggregate or macro levels of production and general levels of prices in the farm sector of Ontario.

The possible existence of an inverse relationship between agricultural marketings and prices has important implications for any trend toward lower future levels of production that might appear.[1] For example, higher general prices that were the result of lower aggregate marketings could reduce the need for a programme of public support for agriculture.[2] On the other hand, evidence that did not support a strong inverse quantity-price relation at a macro level would divert attention away from agricultural supply management toward factors (and the relief measures associated with them) that might be shown to be more important determinants of farm income and its fluctuation over time.

In order to trace variation over time in the level of aggregate

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[1] As indicated at the outset of this report, it is suggested by some that lesser production will be the inevitable long-run result of failure to reduce or otherwise control the present rate of decrease of farmland acreage in Southern Ontario.

[2] It is not intended that this deny the need for specific adjustments of the production of major branches of agriculture from time to time. Furthermore, higher prices that followed lower marketings would not necessarily imply a generally satisfactory income position for individual farmers. On the contrary, major readjustment within the industry (say, reduction in the population of farmers) could remain an important requirement.

quantities of agricultural commodities sold off farms in Ontario it is necessary to commence with the historic series of total farm cash receipts and deflate them by an index of prices received over the same time period. The necessity for using a revenue series as the basis for this analysis stems from the fact that neither weight nor volume is a satisfactory measure of physical productivity in the circumstances. For example, an unjustifiable decline in physical production would result from the use of a weight basis in the event that proportion of total farm output in the form of livestock and their products should have increased over time at a time when the weight of total production remained constant. On the other hand, the measurement of output in value (dollar) terms better accommodates the diverse nature of the agricultural product mix when the purpose in hand is interregional comparison of productive performance; and better accommodates change in this mix over time for both interregional and intraregional analyses.

The plot of deviations from trend in total farm cash receipts of Ontario farmers "deflated" by an index of prices received is shown in Figure 41 for the period 1935-1968 as the trace of quantity of farm marketings.[1] Separate traces of the deviation from trend of the receipts themselves and of prices are also given for purposes of comparison.

The trend in question is long-time growth or increase over the period 1935-1968 calculated as straight-line arithmetic trend. For quantities of farm marketings (as defined) this trend calculated as an annual average growth of about 2.3 percent. Corresponding average

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[1]Data on total cash receipts were obtained from D.B.S., "Handbook of Agricultural Statistics", Part II, Farm Income--1926-65, Cat. No. 21-511, June 1967. The index of prices for the period 1935-1967 was that in Index of Farm Prices of Agricultural Products published in D.B.S. Cat. No. 62-529, September 1969. The index number for 1968 was obtained from Cat. No. 62-003, Vol. 26, No. 10, October 1971.

annual growth or increase for total farm cash receipts and for the index of prices received by farmers was approximately 5.0 percent and 3.1 percent respectively.[1]

The plot of Ontario farm cash receipts and marketings (expressed relative to a base 1969=100) over time is given in Figure 42. The graphs clearly show the long-time upward trend in both series. They support the rationale for extracting this kind of growth when the analysis is concerned principally with short-term price and quantity variation (as it is here). At the same time, Figure 42 and the plot of percentage change in cash receipts and marketings (given in Figure 43 for purposes of comparison) support the calculation of long-time growth in both series as straight-line arithmetic trend.

Data on the growth of levels of agricultural production in Ontario are also available from indices of physical production calculated by Statistics Canada for the province. As mentioned in Chapter 1, this series avoids interprovincial duplication as far as possible by eliminating feed grain and feeder-cattle purchases from other provinces. At the same time, production in any year that is stored or otherwise adds to farm-held inventories is included. Figure 44 graphs physical production as estimated by this series and by deflating total farm cash receipts by farm prices (shown in Figure 44 as Index of quantity of marketings). Comparison of the two traces over the full period 1941-1968 suggests (1) a lower level of dependence of Ontario on "intermediate" agricultural products -- probably largely feedgrain and feeders from the prairie provinces -- from the late 1940's on, and (2) fluctuations of marketings over the 20-year period 1948-1968 that were not significantly different

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[1]The long-time trend of farm cash receipts was calculated over the slightly longer period 1929-1968, however. An annual growth rate of 5.4 percent presumably would have resulted from calculation as an average for the period 1935-1968.

from the fluctuations of physical production over the same time span. Although pronounced growth in both series is also evident when data for the whole of Canada (but excluding Newfoundland) are plotted, fluctuations in agricultural marketings are much less severe. The graphs for Canada excluding Newfoundland are given in Figure 45.[1]

Figure 41 shows a relatively weak association between the volume of production (quantity of marketings) and price fluctuations in the opposite direction when the effect of long-time growth is removed from the statistical data. While levels of physical production that grew less rapidly from 1942 to 1951 than the straight line long-time trend rate was associated with prices that increased at a much faster rate than trend over the same time span, there were other instances when production increased rapidly during periods when prices also increased, and a virtual absence of quantity fluctuations during a time of fast-falling prices. For example, the quantity of agricultural marketings grew rapidly during 1940-1942 when prices also increased. The substantial decline in prices between 1951 and 1957 was associated with only minor fluctuations in the volume of production (both relative to long-time trend) over the same period.

For Canada excluding Ontario and Newfoundland, a somewhat similar picture emerged - Figure 46. For example, the periods of 1940-1944, 1946-1948, and 1950-1951 were times when the quantity of farm

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[1]Two additional points with respect to Figure 45 are also noteworthy. One is the evident lag of the "marketing" index series behind the "production" series. The second concerns the generally lower disposition of the index of quantities marketed. This is not evident in the graph for Ontario only (Figure 44). Explanation may lie largely in 1949 having been a year of generally large additions to farm-held inventories of grain and livestock throughout Canada as a whole.

marketings and price both rose at faster rates than trend; and 1953-1955 was a period when both variables decreased relative to trend (but also exhibited absolute decline). In fact, the whole period 1955-1968 was generally one of "perverse" quantity-price behaviour.

We might, therefore, conclude that deviations of agricultural production (quantity of marketings) from its long-time growth do not necessarily explain price changes.

Change in Farm-Input Prices

Agriculture, just as any other industry, can be expected to respond to differential change in the price of the factors of production it employs. Historical patterns of price change for the major categories of Ontario farm inputs for which series data are available are examined here. The immediate task, however, is to establish the recent relative importance to Ontario agriculture of different categories of expenses and charges and to examine the change that has occurred in this distribution of total farm costs since post-Depression years.

Table 35 provides information on both the percentage distribution (as an average for 1935-1939 and for 1956-1960) and the change that has occurred between the two periods of record. It will be noted from the table that for 1956-60 feed purchases (through commercial channels and excluding direct inter-farm transfers, but including shipments from other provinces) rank as the highest single item of expense or charge, whereas combined machinery costs were so placed in 1935-39. Nevertheless, the latter category of cost for 1956-60 was still relatively more important than for the earlier period, although this specific outcome could be explained by increases in the rate of depreciation assumed[1]. Decline is evident in the relative importance of farm-labour wages, taxes, interest on indebtedness, gross farm rent and building costs (depreciation and repairs combined). With respect to the last category, part of the relative decline can be attributed to a reduction in the depreciation rate on the value of farm buildings, from 4 to 3.5 percent. On the other hand,

---

[1]Commencing in 1952 depreciation rates for machinery were gradually increased from an average 7 percent to reach 11 percent on farm machinery and 12 percent on auto and truck values by 1967.

TABLE 35

Percentage Distribution of Farm Production Costs[a], Ontario, 1935-39 and 1956-60, and Percentage Change, 1935-39 to 1956-60.

Item	1935-39		1956-60		Change
		percent			
Feed		17.0		23.1	+35.9
Machinery					
Operating[b]	11.5		9.9		
Depreciation	6.7		8.3		
Repairs	2.4		3.5		
		20.6		21.7	+5.3
Wages to Farm Labour		16.8		13.5	-19.6
Interest on Indebtedness		9.4		3.2	-66.0
Buildings					
Depreciation	9.9		5.7		
Repairs	3.3		3.9		
		13.2		9.6	-27.3
Taxes		9.1		5.2	-42.9
Gross Farm Rent		4.3		2.5	-41.9
Fertilizer and Lime		2.6		4.9	+88.5
All other Operating Exs.		7.0		16.3	+132.8
TOTAL		100.0		100.0	

[a]Total Farm Operating Expenses and Depreciation Charges

[b]Total Machinery Expenses less Machinery Repairs

Source: Dominion Bureau of Statistics, "Handbook of Agricultural Statistics", Part II, Farm Income 1926-65, Cat. 21-511, June 1967, Table 7, pp. 75-94.

values themselves were higher to the extent that the practice of renting farms had declined in 1956-60 relative to 1935-39[1].

In passing it is interesting to note that property taxes on Ontario owner-operated farms as a percentage of total Ontario farm operating expenses and depreciation fell from 9.1% in 1935-39 to 5.2% in 1956-60. The magnitude of this decline would seem to suggest that, generally speaking, property taxes are not an increasing reason for agricultural retrenchment for which policy solutions must urgently be found. The relative decline in fact probably represents very moderate rate increases coupled with an assessment base set at less than full market value.

Price-index series (1935-39 = 100) for Eastern Canada are available for feed, farm wage rates, farm machinery, gas-oil-grease, tax and interest rates, and fertilizer, among other groups of commodities and services used by farmers. Price-index numbers (1935-39 = 100) for the value fo farm land and buildings per acre were calculated by using appropriate value and acreage data from the 1931, 1941, 1951, 1961 and 1966 censuses of agriculture, assuming a straight-line trend in values between any two succeeding census years, and employing 5-year moving averages for the estimation of individual years. The plot of the first three groups plus land and buildings per acre compared to the plot of index numbers corresponding to prices received by farmers is shown in Figure 47.

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[1]Depreciation on buildings covered only farm buildings on <u>owner-occupied farms</u>. Repairs were similarly estimated. The same was true for taxes. The relative importance of gross farm rent declined between the two periods, consistent with the decline in rented farm acreage expressed relative to the total acreage in census farms. Rented farm acreage as a percentage of total farmland declined from 15.0 to 11.7 percent between the censuses of 1941 and 1961.

As might be expected, there is little correspondence between the trace of farm-product prices (prices received by farmers) and the traces of input prices. The exception is feed which is largely a farm-produced commodity. In this case the differences that exist can be explained largely by the fact that feed prices will have been weighted rather more heavily with grains than the general run of farm-product prices.

In Figure 48 the Eastern Canada index series for feed, farm-wage rates and farm machinery, together with those for gas-oil-grease and tax and interest rates in addition, are plotted relative to Ontario per acre farm land and building value index numbers for the period 1935-1966. Including land and building values and allowing only for depreciation on farm machinery, these groups combined accounted for nearly two-thirds of farm operating expenses and depreciation charges in 1960.

A universal and steep decline in the index relatives from 1951 to 1964, and generally to 1966, is evident from the graphs presented. Highlights for the individual series are as follows:

Feed	-	index relatives erratic until 1950, then consistently and steeply declining for the remainder of the period of study.
Wage Rates	-	very steeply rising during the mid- and late 1930's and the early years of World War II, "peaking" in 1948 and then declining rapidly since that time -- except for minor peaks in 1951 and a tendency to rise between 1964 and 1966.
Machinery	-	generally declining since 1942, but with a secondary peak in 1948.
Gas-Oil-Grease	-	steeply declining since 1942 except for a minor peak in 1948.

Tax & Interest Rates - the decline has been less precipitous than other groups and barely affected by "1950" influences.

There is some evidence of a general tendency of the price ratios to have been upward for several decades before 1940-42. If we discount as atypical the period of unsettled prices for the few years centred on 1950 (commonly associated with rapid inflation induced by the Korean War), the price ratios considered show a pronounced general tendency that is downward since 1940-42. In other words, the indications are that a definite break in the trend of the prices of important groups of nonland inputs to the price (value) of farm land and buildings occurred during World War II.

Such a trend break could be expected to have encouraged land-saving characteristics within the agricultural industry of Ontario since the early 1940's. Rather obvious examples of technological change in agriculture that work in the direction of land saving (in a figurative sense) are increased applications of fertilizers, weedicides and pesticides, the breeding of superior strains of plants and animals, the increased purchase of feedgrains from "outside" sources, and the intensive raising of poultry and other livestock in controlled environments. The first three mentioned have probably all been important aspects of technological change in Ontario agriculture since World War II. Unfortunately, Table 35 is not specially designed to illustrate or refute the aspects of change specifically described above. It brings out only the substantial increase in the relative importance of fertilizer and lime expenditures between 1935-39 and 1956-60. While the importance of purchased feed rises some 35 percent, Table 35 is silent as to whether its source was or was not Ontario.

It might be postulated that the land-saving influences increasingly at work in Ontario have led to a slackening in the demand for land by bona-fide farmers. It would be erroneous to conclude, however, that the situation was as simple as that. There is, for example, a demand by successful farmers for land to increase the size of their holdings. This is now discussed.

As indicated in the preceding section, Change in Farm Size, the average size of farm in each of the counties of Southern Ontario increased between 1951 and 1966, and there is other empirical evidence that suggests consolidation of farm holdings during that period. Such changes, however, do not necessarily deny the existence of a general tendency toward land-saving within the agricultural industry as a whole. Rather they can be conceived as representing structural evolution of the industry -- from small units owned and operated predominantly by families toward a larger scale and more corporate kind of farm structure. The efficiency spectrum among the population of farmers is so wide that the demand for "expansion" land could reasonably be expected to be satisfied by sales from the less efficient to the more efficient. A redistribution of this kind is not necessarily inconsistent with a contemporaneous areal contraction of the industry as a whole. The resulting increase in the average acreage of the unit can be viewed as more a reflection of business and managerial reorganization than evidence that is contradictory to a land-saving hypothesis[1].

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[1]The rather moderate decrease in the relative importance of farm-labour wages as an item of production cost between 1935-39 and 1956-60 (Table 35) despite very large increases in wage rates may, in fact, provide supporting evidence of the structural reorganization suggested here.

The effect of land-saving forces operating within agriculture will, too, be dampened and concealed to the extent that food demands rise over time with increases in population and per capita income.

We might theorize that a weakening of the demand for land within agriculture associated with land-saving influences at work since World War II could likely impact that quality of land in farms that was least responsive to increasing application of nonland inputs. Land unimproved because of poor drainage, steep slopes, shallow and stony soil is of such a quality. It is, moreover, land that may often be under forest cover and sought by nonfarm interests for its amenity value. The empirical evidence already presented on the grossly different rates of loss of "improved" and "unimproved" land gives strong support for this view. Moreover, it will be recalled from the preceding section that increases in farm size between 1951 and 1966 were smallest for counties generally comprising what has been called the agricultural heartland of Southern Ontario, and largest for Shield counties and the eastern region. An explanation of these regional differences in increase may also rest with diminished ability to respond to increasing applications of nonland inputs.

FIGURE 41.

Farm Cash Receipts, Prices Received, and Quantity of Marketings Ontario,

1935-1968 (Trend=0)

FIGURE 42.

Total Farm Cash Receipts and Quantity of Farm Marketings, Ontario

(1961=100)

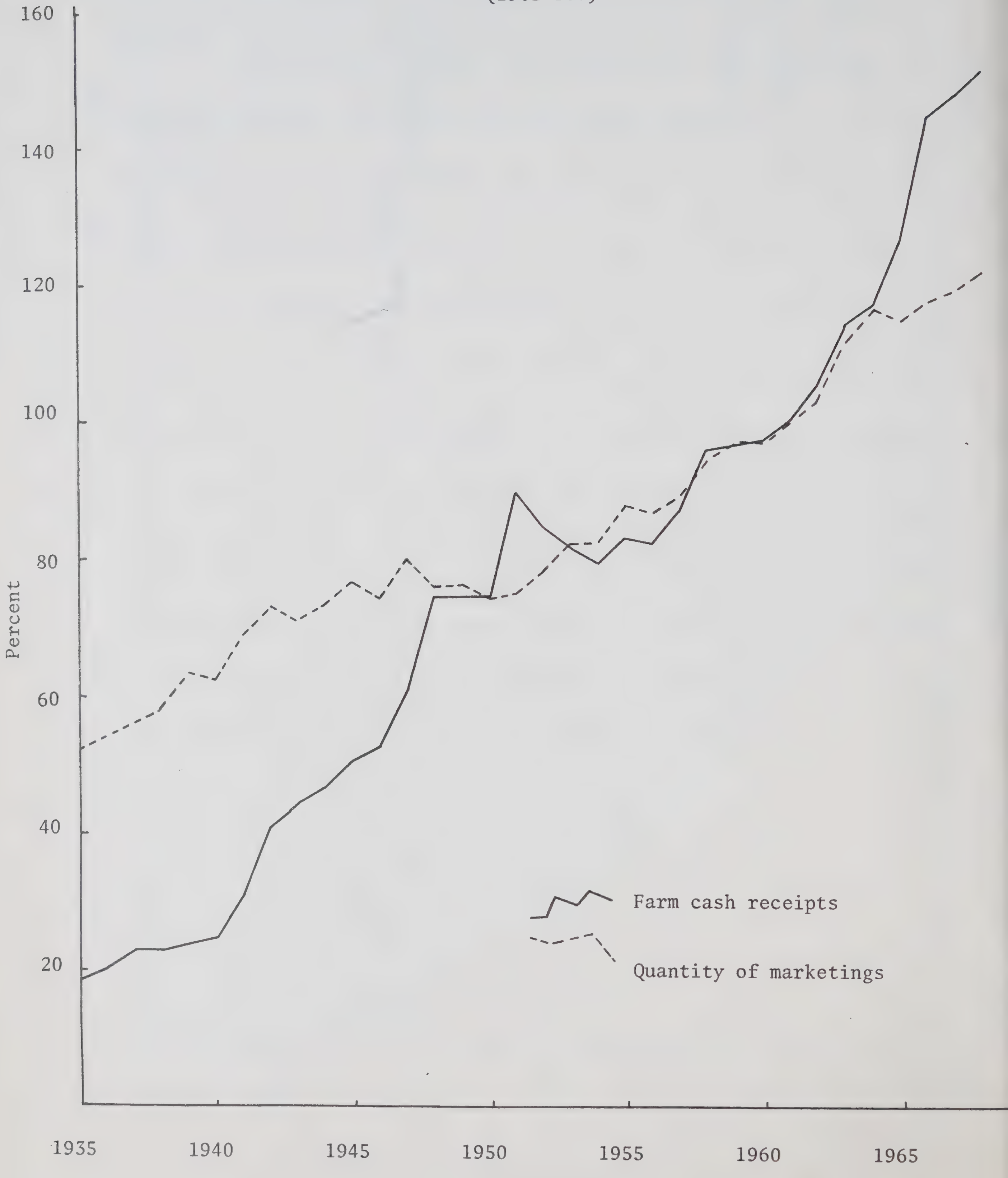


FIGURE 43.

Total Farm Cash Receipts and Quantity of Farm Marketings, Ontario

(1961=100)

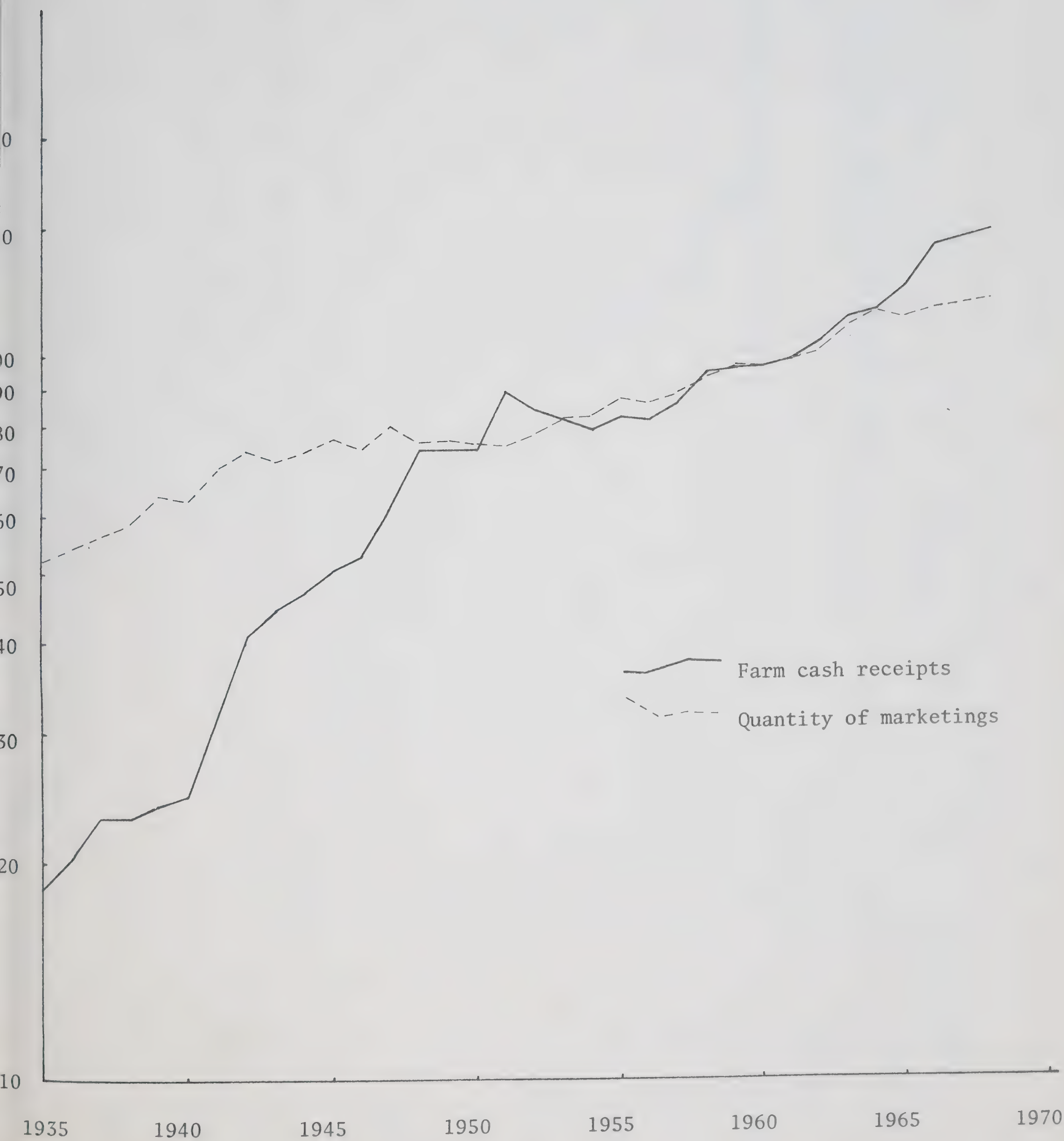


FIGURE 44.

Physical Production and Quantity of Marketings Index Series Ontario, 1941-1968

(1949=100)

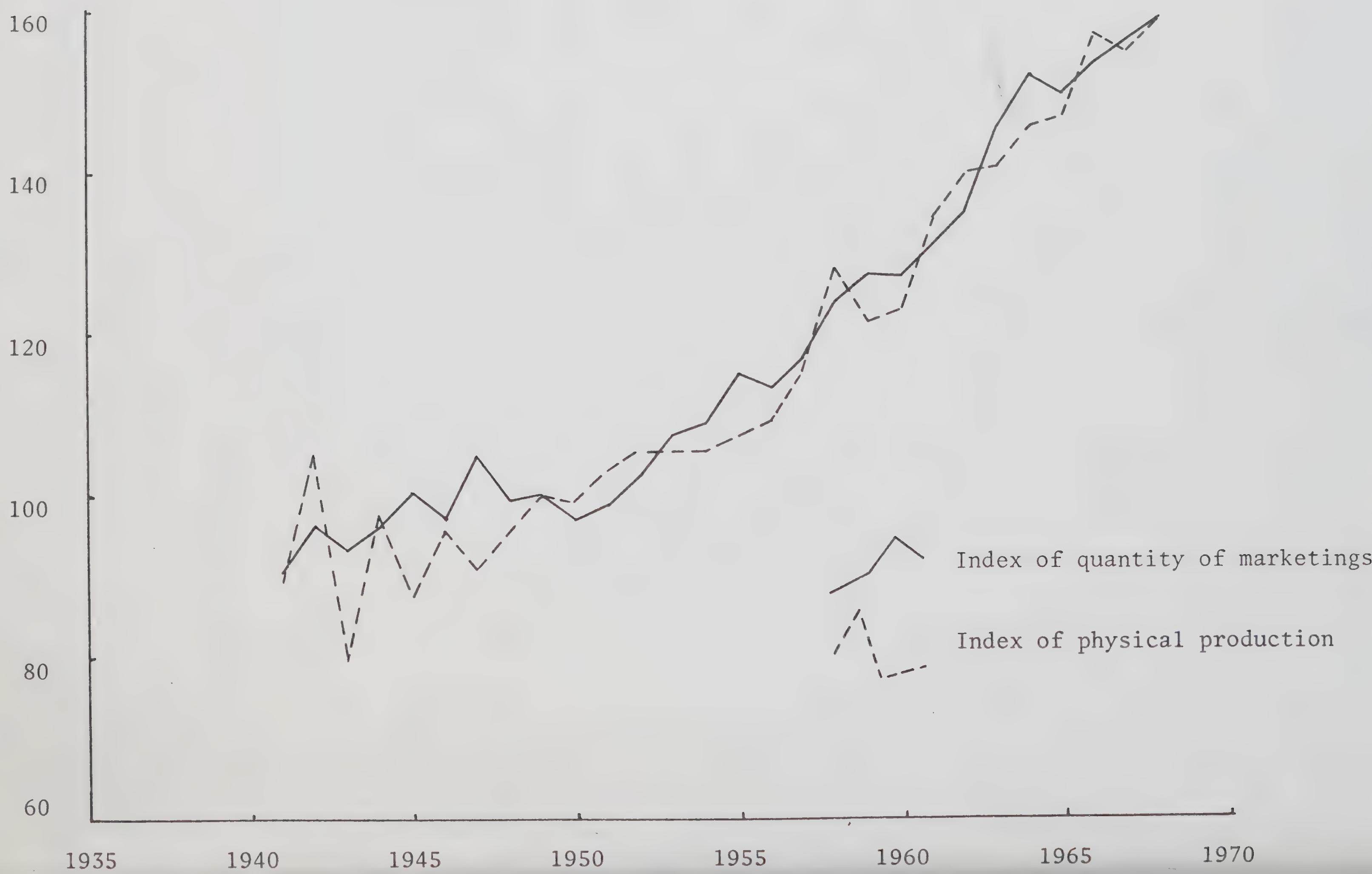


FIGURE 45.

Physical Production and Quantity of Marketings Index Series
Canada (excluding Newfoundland), 1941-1968

(1949=100)

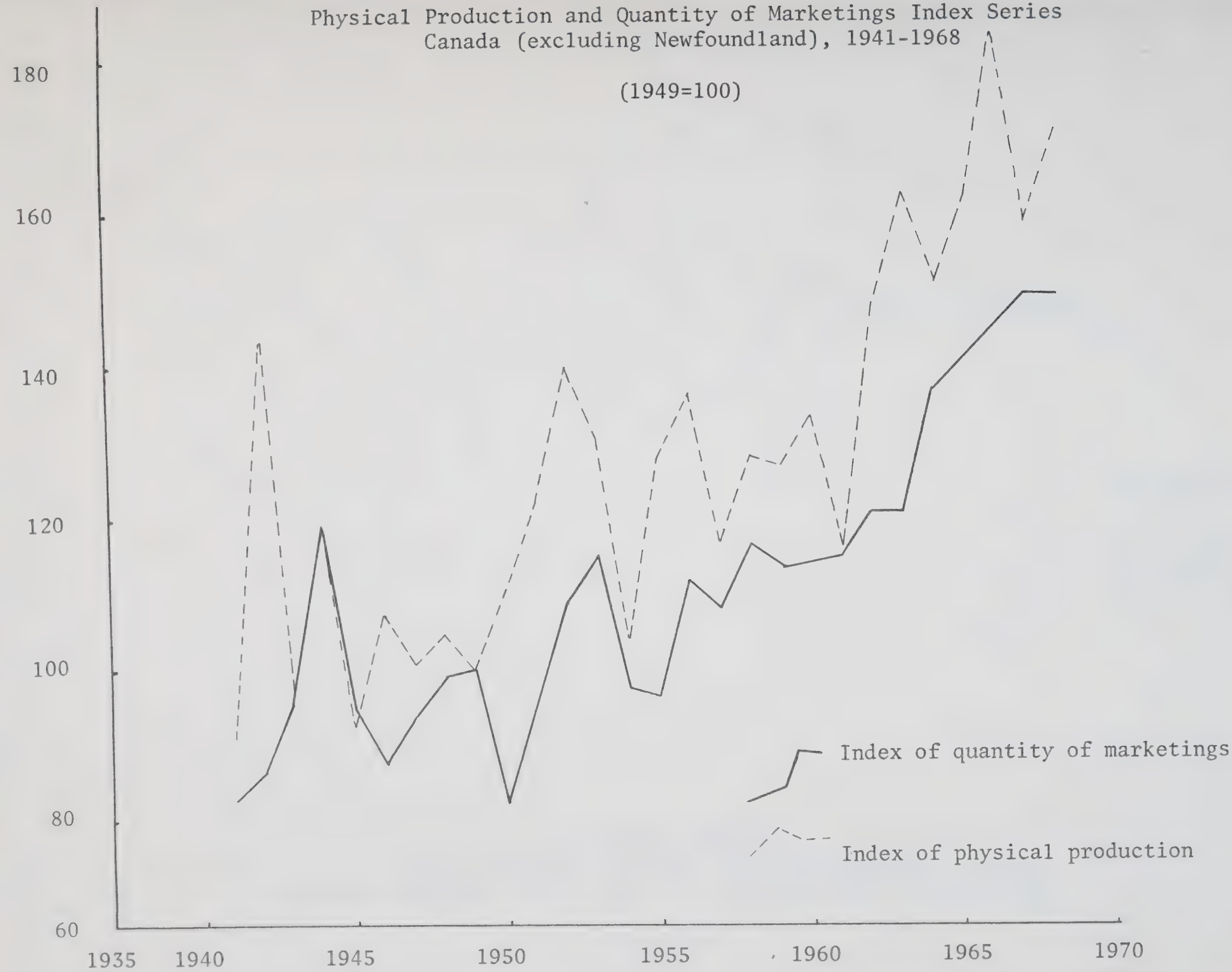


FIGURE 46.

Farm Cash Receipts, Prices Received, and Quantity of Marketings
Canada (excluding Ontario and Newfoundland),
1935-1968 (Trend=0)

FIGURE 47.

Prices Paid for Labour, Machinery, Feed in Eastern Ontario;
alue of Land and Buildings per acre, and Prices Received by Farmers in Ontario, 1935-1966
(1935-B9=100)

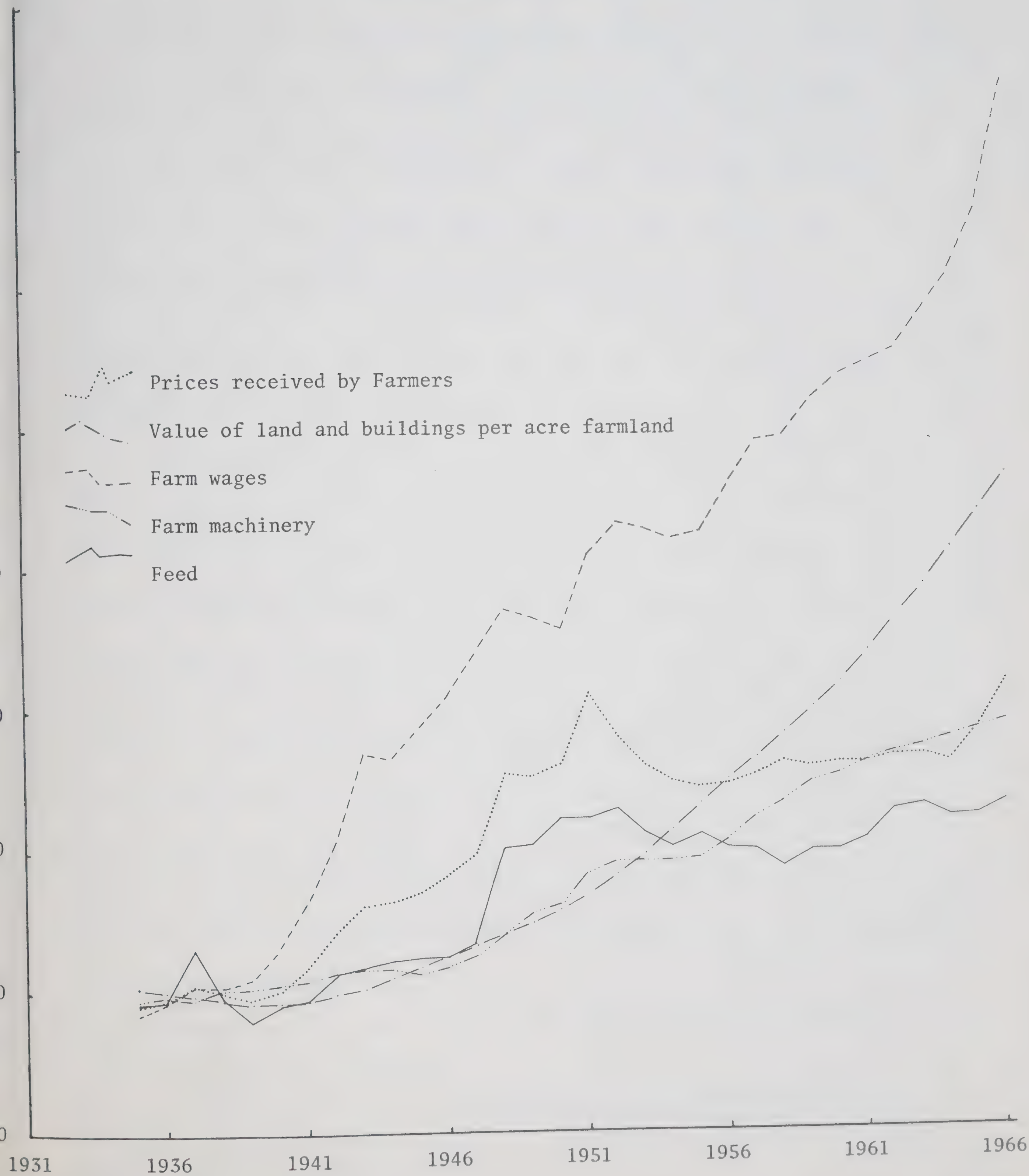
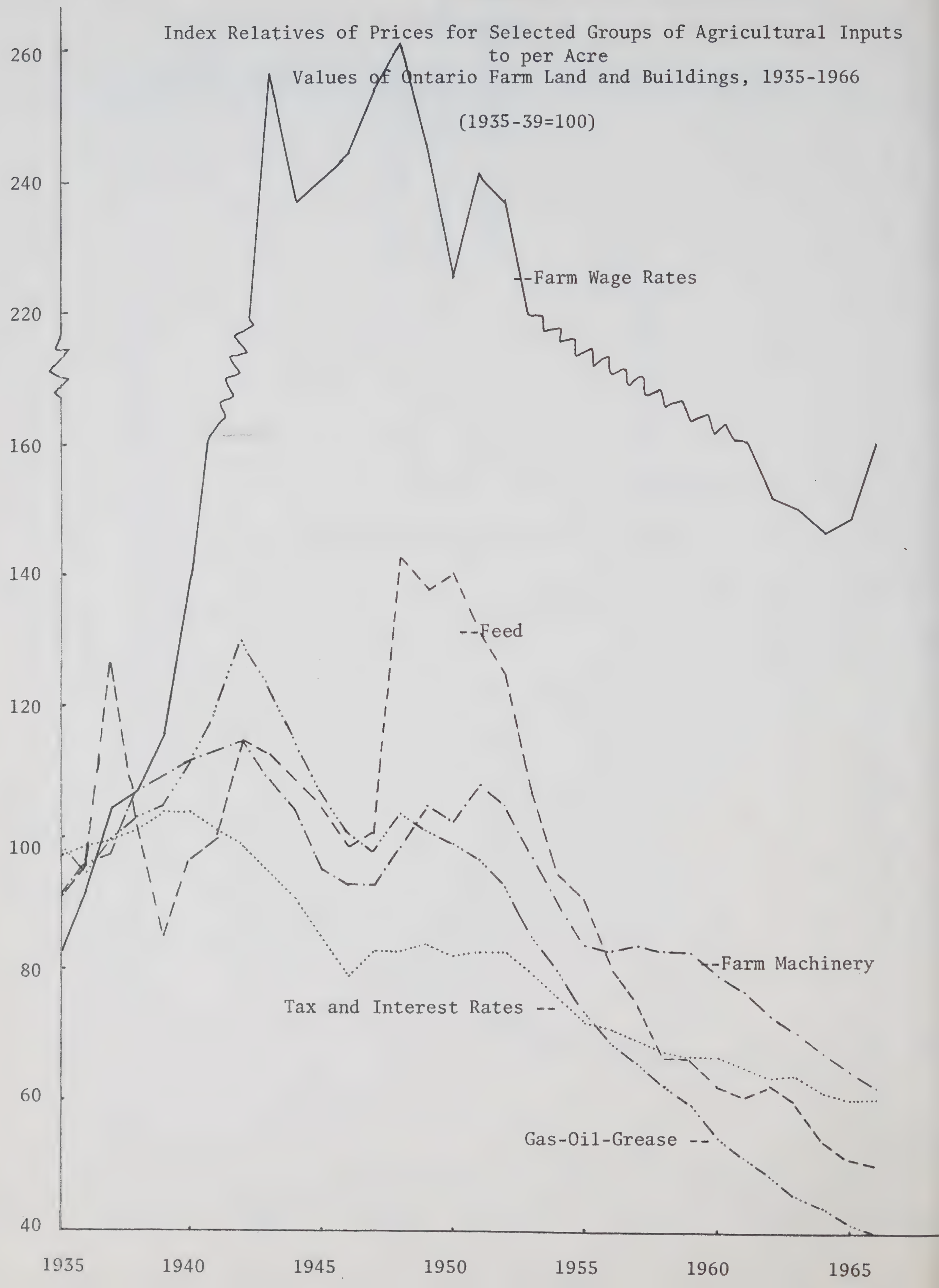


FIGURE 48.

Index Relatives of Prices for Selected Groups of Agricultural Inputs to per Acre Values of Ontario Farm Land and Buildings, 1935-1966

(1935-39=100)



ANALYSIS OF INTENSITY OF NONLAND INPUTS USED ON FARMLAND

1. Interpreting the Intensity of Farm Use of Land

The concept of "intensity" of farming use of land requires some special clarification, because the word has both a popular usage and a theoretical meaning. The popular usage is inevitably very vague and imprecise, whereas the theoretical meaning tends to suffer the frequent problem in theory of being precise but abstract and non-operational. The definition used here is the theoretical concept of the relation between the nonland factors of production and the land factors of production in a given enterprise[1].

The concept of intensity of land use is defined to be the relationship between land and the value or quantity of the inputs of other kinds of factors of production, primarily labour and capital. Thus, the concept is measured by the ratio of the nonland inputs per acre of land. In this context one of the objectives is to examine the intensity with which agriculture in each area of the study region is actually using the land resource in farms. The measure is an estimate of the amount of direct inputs of nonland resources applied to each acre of land used in farming during a year of operation.

The meaning of these figures can be described in several ways. They are intended to estimate the quantity of basic factors of production within local agriculture which have been devoted to an attempt to generate income from farming the land. It is an estimate of how much nonland

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[1]See E. S. Dunn, Jr., The Location of Agricultural Production, (U. of Florida Press, Gainesville, 1954) pp. 30-36, 44-45, 108. Raleigh S. Barlowe Land Resource Economics, (Prentice-Hall, Englewood Cliffs, 2nd Edition, 1972) pp. 111-114, 120-155.

resources within local agriculture are being supported by this farming operation, or has at least been considered worthwhile to put into this area of land. The resources of labour and capital which have been applied on each acre of land could have been made larger or smaller, or removed altogether to other kinds of nonfarm activities elsewhere. These estimates are essentially a measure of the "opportunity cost" of the nonland resources used on the land. In addition to actual cash expenditures for nonland factors of production which were hired or paid for in cash, we have included a cost imputed to the farmer's own resources in his labour, his family's labour and his equity in the livestock and poultry and his machinery and equipment. We do not know how much income was actually earned from the effort; in the most successful areas the income would far exceed these costs, and in other areas the income would be inadequate to provide a return as large as the cost imputed here to the operator's owned factors of production.

The estimated value of the nonland resources devoted to farming operations is used in two quite distinct ways in this analysis. The concept outlined above is oriented to the land resource, and studies the average ratio of nonland resources to each acre of land. In addition we can examine the value of the nonland resources separately, without considering how much farmland was used; and we can compare the change in one region's total quantity of farm labour and capital to the change in another region's use of farm labour and capital. Section 3 below is an analysis of these aggregate quantities, while the succeeding sections are devoted to analyses of the average intensity of land use which relates labour and capital to the land resource.

These estimates permit comparison among the different areas of Southern Ontario, and it is the relative differences which are important rather than the absolute level of the numbers. Similarly, it is possible to compare the different kinds of change which took place between 1951 and 1966 in the various areas of the region: comparing by soil type, climatic zone, product type, or any other dimension.

Generally speaking, under Ontario conditions, the higher the intensity the higher the economic rent of land which is generated by farming. More important, the changes over time give an indication of the changing competitive position of farming in different areas relative to other farming areas. Some areas are capturing larger and larger shares of the market, because of superior cost and output performance. Areas which are "becoming better at farming" compared to other areas will tend to show higher rates of increase in the intensity of their land use as they find it worthwhile to add more and more other factors of production to each acre of land.

A fundamental principle in the economics of production when there are substitutable factors of production is that one should "economize" the relatively expensive factor of production, by substituting for it the relatively low-priced input as much as possible within the limits of one's technical ability to replace one with the other. Thus, if land becomes more expensive at a rate faster than the rise in wages, it is rational to apply more labour to each acre of land. It is approximately true that the cost of labour is equal everywhere in Southern Ontario, just as the rate of interest on borrowed capital is also approximately equal everywhere.

Against the fact we must consider the effects which arise from the fact that the price of land varies immensely from area to area across Ontario. There are several aspects of the price of land which we can identify, and each varies considerably from region to region: (a) the economic rent and value which agriculture can generate currently, (b) the economic rent and value which alternative land users can currently bid, and (c) the expected rates of change of land prices into the foreseeable future. The inevitable economic result is that land is economized in some areas while in other areas the tendency is to economize on the use of labour, i.e., the ratio of land to the nonland factors or production will vary from region to region. There are dynamic trends in (a) the prices of land, labour and capital and (b) the relative productivities of the various soils and climatic areas, and (c) in the prices and quantities demanded in each kind of farm product; consequently there are continuous changes in the way in which labour and capital are applied to land.

The technology of farming varies from product to product: some inherently require large inputs of labour and capital on each acre of land while others can make productive use of only small amounts of labour and capital per acre, and these are, respectively, intensive and extensive kinds of farming. In addition, it is vital to recognize that most kinds of farming have considerable flexibility in their technology and can be carried out with quite a wide range of intensities, with the optimal choice depending on the relative prices of land, labour and capital in the individual region.

The empirical analysis which has been done here has been designed to accomplish certain tasks in a rather specific way. The objective was to compare farming in different regions and at different dates, largely

in terms of determining those areas which are showing greatest general competitive ability in the industry as a whole, and to relate this competitive performance to main factors such as soils, climate and urban area influences. The method required the estimation of the quantity of nonland factors of production used by farming in each area, (a) as an aggregate quantity and (b) measured in relation to the land factor of production. This enables the comparison of how much each region is giving or losing in its relative share of the Ontario agricultural industry, and also an analysis of the area's behaviour in its relative intensity of land use.

The labour resource which is measured here is the portion of the farm operator's work-year which has not been occupied with off-farm employment, valued at the average cost of farm labour, plus an allowance for the work usually supplied by members of the family. In addition, actual cash expenditures for hired labour are included. Clearly this measures the labour resource which was available for use, valued at its opportunity cost, which is a different concept from either (a) the net income earned from the work on the farm and (b) the cost of the actual hours of work expended in the operation of the farm.

Similarly, the capital resource being applied to farming (excluding land) was estimated, so as to add together labour-plus-capital and relate it to the land resource. The relevant measure is the opportunity cost of having a certain capital asset tied up for a year, i.e., the rate of interest which would have to be paid on borrowed capital or which could be earned by lending the funds in alternative uses. It is irrelevant for these purposes whether the farmer actually borrowed the funds he was using or whether he was providing the capital as equity; for every dollar of nonland capital assets in use for the year, there is an actual cost or an opportunity cost. Unfortunately the data were

not available to estimate the capital values of buildings or operating capital.

Quite simply, then, the objective in the estimation technique was to measure the quantity of the factors of production (resources) of labour and capital used in each local area, within farming itself. This measure can then also be used to calculate the intensity of land use, with intensity defined as the ratio of the nonland factors of production per unit of land.

A major question is whether to include inputs of materials purchased by agriculture in each area either (a) from other farms, probably in other regions of Canada, or (b) from other industries. Obvious examples are feed-grain purchased from the western provinces, and fertilizers or fuels purchased from the manufacturing industry. Neither of these examples represent resources provided by the farming industry in a particular local area, except to the extent that purchased materials and services do constitute operating capital and have an associated actual or inputed cost of interest on capital for the short period they are on the farm.

The decision in the analysis was to exclude all operating expenditures on purchased materials and services, because such amounts did not conform to the concept which was established for the intended purposes. In any case there are major problems of estimating such expenditures. The main issue, however, is that such expenditures represent the resources provided by other industries or other regions. It was important, in addition, to achieve comparability of the measure among the vastly different kinds of farming in the various parts of Ontario.

A simple hypothetical example illustrates the issue. Imagine two farm units, of equal acreage such as 1 acre, and each with the same total value of capital investment in machinery, equipment, buildings and

livestock: such as a feedlot and a greenhouse. Imagine that each spends $10,000 on that acre of land, but that the greenhouse hired $10,000 of farm-labour while the feedlot spent $1,000 on labour and $9,000 on purchased western feed. There can be no doubt that the greenhouse in that township or county represents a larger quantity of local farm resources devoted to agriculture and a higher intensity of local nonland farm resources per acre. The feed was produced by labour and capital (plus the land resource) in some other area.

Operating expenditures for purchased materials are costs, just as the farmer's labour and capital represent costs, but they play a different role, being purchased in order to provide a return to the labour, capital and land which was in the farm industry in this area.

This is an attempt to pursue the classic "factor proportions problem" of economics, although to apply it in a more complex context of many types of farming, and in the real-world situation where many other factors are changing in addition to the relative prices of land and the other resources. Unlike the usual study of factor proportions, this study does not place major emphasis on interpreting differences in the proportion of other resources to land in terms of differences in the ratio of the price of land to the price of the other factors. This is because we are dealing in Southern Ontario with vastly different types of farming, with different production functions.

A major premise in this study is that given (a) the economic circumstances and trends of agriculture in Southern Ontario, and (b) the socio-economic characteristics of the industry, increases in the quantities of nonland resources can be related to relative shifts of competitive performance and general productivity in each sub-region.

2. Estimating the Inputs of Nonland Resources

The goal was to measure the amount of labour, property taxes and capital applied to the land. The estimate of labour input is an estimate of (1) the cost of the portion of his labour year which the farm operator devotes to the farm, plus (2) a provision for the work of family members who are not paid a cash wage, together with (3) the expenditure on hired labour. The time of the operator and his family is valued at the average Ontario cost for hired labour including the value of room and board. The number of days off-farm work of the operator is deducted from his work-year on the farm. The relation of family unpaid labour to labour provided by the operator (after deducting off-farm employment), was in the proportion of 0.3:1 in 1951 and 0.4:1 in 1966. The labour is measured in current dollars, with a month of labour valued at $120 in 1951 and $236 in 1966, reflecting the effects of (a) change in the general price level and (b) rise in the productivity of labour in farming generally.

Property taxes are included as a measure of the input of community services to the farm operation and family in the form of local roads, schools, and other services. The level and quality of these services varies with the type of farming and the need or ability of the community to pay for these resources.

The annual cost of the capital value of livestock, poultry, machinery and equipment is estimated simply by the current rate of interest on farm credit applied to the current level of the capital values excluding the value of land and buildings (5.0% in 1951 and 6.4% in 1966). This is an estimate of the cost of possessing that amount of capital value, and is not intended to measure the cost of operating the farm enterprise.

3. Change in Total Inputs on Farms 1951 to 1966

The estimated values of the labour and capital used in farming can be viewed in the aggregate in an area, as well as expressed in dollars per acre of land which is discussed in another section. The total quantity of inputs used in an area is an indication of the relative size of the farming industry in that area. It is of particular interest to compare areas in terms of their changes from one date to another in the nonland inputs used on farms. This permits a comparison of whether an area is supporting a larger quantity of agricultural activity than it did at an earlier date, measured in terms of the non-land resources devoted to the activity on the farms.

In 1951, these 45 counties in Southern Ontario used an estimated total input of $363 million of nonland agricultural factors of production. In 1966, in current dollars, that input amounted to $540 million, a rise of 48.8% from the earlier level[1]. However, it must be remembered that the prices of some of these inputs were rising faster than that rate. For example, the wage rate imputed to unpaid labour in these estimates rose by 97%. The index of farm machinery prices rose by 57% from 1951 to 1966, and the rate of interest charged on farm credit rose from 5.0% to 6.4%, making a total cost rise of about 73% to own a given amount of machinery and equipment. The price of livestock generally was lower in 1966 than in 1951 and the real capital asset of livestock and poultry on farms was clearly larger in 1966 than in 1951. Such comparisons are fraught with ambiguities and complexities, but it would appear in general that although the dollar amount of nonland inputs rose by 48.8%, the

[1] In contrast, and revealing the extent of expenditures for operating supplies such as fertilizers, fuel and feed, the 1951 and 1966 total farm cash receipts for all Ontario were $784 million and $1,254 million respectively (+60%).

real physical inputs involved were actually probably being reduced somewhat in aggregate, particularly the labour.

There are two main kinds of comparisons that can be made among areas: (1) how is this area performing in terms of its share of the total provincial activity, and (2) how is this area behaving in terms of the method used to carry on its activity. The first comparison is the subject of this section, and stresses how big each area is in relation to the others, and whether it is becoming relatively bigger. The second comparison is the subject of other sections and stresses the average inputs on each acre, regardless of how large is the total quantity involved.

There is a striking difference between the spatial pictures we see in these two kinds of comparisons. When we are comparing areas on the basis of their inputs per acre of land used in farming, there is a strong tendency for the higher levels of intensity to be clustered near the major urban centres, and for the increases in inputs to be highest near the urban centres. On the other hand, in dealing with the total size of the industry in each area, and its growth over the time period, the strongest performance is not correlated only with nearness to cities but it appears to be correlated also with climate and with soil capabilities.

Figure 49, indicating the percent change from 1951 to 1966 in the total nonland inputs used in each county, shows a striking and unambiguous relation among the counties. Although we cannot say what level of percentage change indicates a zero change in real physical inputs, it is clear that in some areas there is a clear gain in share of agricultural activity, and in other areas there is a clear loss in relative share.

The highest rates of increase in inputs are to be found in a group of ten contiguous counties in the extreme southwest, and in Lincoln as well. These eleven counties are the only ones with rates of change over 60%, and every county within that area has these high rates. This is a solid region which is capturing a rising share of the Ontario agricultural industry as a whole.[1]

There are two other distinct regions on Figure 49, divided by a boundary which we have seen emerge many times in these analyses, running from Belleville to Midland. The middle region includes the Niagara Peninsula, the western Lake Ontario shore along the Hamilton-Toronto urban corridor and the southern part of the Georgian Bay region. Of this group of sixteen counties, all but three had above the median growth of 47%; the exceptions are Dufferin, Peel, and York; and Dufferin is in fact the highest county below the median. The third region, to the northeast includes nineteen counties, not one of which had a growth rate as high as the median, and it includes all but three of all the counties below the median. It appears almost certain that this northeast region as a whole had an actual shrinkage of physical agricultural activity in aggregate; it clearly is losing in its share of the Ontario market.

One of the basic forces which has created this asymmetry between the northeast and the southwest is the asymmetry within agricultural technology and its improvements. Most advances in crop and livestock breeding and production technology tend to be oriented to the conditions of the warmer parts of North America and to the more intensive forms of agriculture. There is relatively little emphasis on advancing technology

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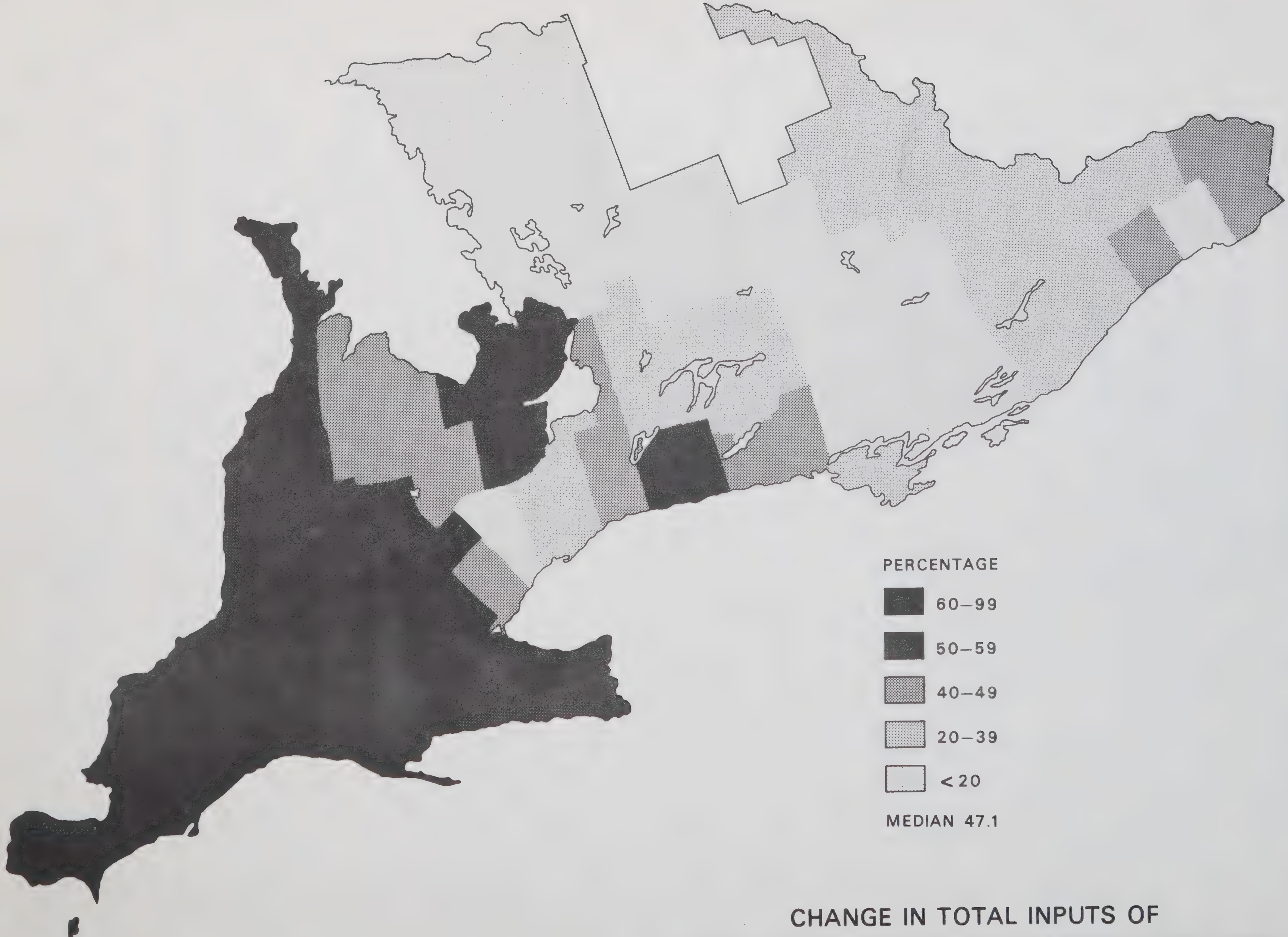
[1]A contiguous tier of six counties could be added to this first region; all of which had more than a 50% rise in inputs, taking in all the area from Niagara to Hamilton and up to the Bruce Peninsula.



CHANGE IN TOTAL INPUTS OF
NON–LAND RESOURCES IN FARMING 1951–1966

49

TABLE 36

Change in Total Inputs of Nonland Resources, 1951 to 1966

Percent Change	No. of Counties
decrease	4
+ 0 - 9	-
10 - 19	4
20 - 29	4
30 - 39	6
40 - 49	8
50 - 59	8
60 - 69	7
70 - 79	3
80 - 89	1
	45

especially suited for conditions in colder areas or poorer soils or for areas in which land is becoming relatively cheaper. There is enormous spillover into Canadian agricultural science from the United States, and in addition the richer farming areas appear to scientists and government to offer the greatest payoffs to research. However, this can be changed, as demonstrated by the developments in corn breeding which have produced hybrids capable of yielding in the Ottawa Valley as much per acre as other hybrids do in the southwest.

Another basic factor in the unequal directions of adjustment is the economics of production, costs, markets and prices. Because of higher yields and wider choice of crops and livestock enterprises, the southwest areas have lower costs and can supply a larger share of the markets. The local market and processing facilities as a consequence are also predominantly in the southwest. Flows of market information and scientific communication are better, and hence more of the farmers decisions are better founded. Economic success leads to further success and more opportunities.

It would appear that a factor which has somewhat inhibited the rate of growth in total farm activity around the western end of Lake Ontario is the fact of urbanization of the land or the uncertainty surrounding the land market. This is hardly a surprising conclusion in view of the conversion and idling of land. The point is that the rates of growth in the more urban counties are not necessarily the result of factors operating from within agriculture, but may be influenced by factors arising from outside the industry. In fact, we shall see in the next two sections that agriculture can show great strength near the urban centres in terms of the growth of activity on the land remaining in farms.

4. Level of Intensity of Inputs per Acre in 1966

The number of dollars worth of nonland factors of production applied to each acre of land used for farming[1] tends to be increased so long as there are no superior alternatives for those resources and so long as they are creating a reasonably acceptable return. There are many combinations of factors which affect the profitable level of intensity. The most general interpretation that can be made is that the level of intensity per acre probably indicates the relative level of economic rent which is attributable to the land when used for farming, and hence signals those areas in which agriculture can afford to pay more for land than it can in other areas. This interpretation is probably valid for comparisons within general farming, but it is not theoretically justified if we attempt to compare different kinds of farming. It is not correct in theory to expect that the type of farming which generates the highest economic rent per acre will have the highest level of intensity.

The estimates of level of intensity of farming confirm that there is no single factor which explains the amount of inputs per acre. It is clear from the map that at least three major factors are at work in Southern Ontario: 1) the nearness to large urban centres; 2) effects of warmer climate and good general soils, and 3) the presence of special soils and climate which permit special crops such as horticulture and tobacco. There is a strong orientation of high intensity toward the Toronto-Hamilton-London urban corridor. There is a strong tendency for high intensity towards the warmth of the southwest. There are thirdly, the highest levels of intensity in the "poor" sandy soils of the Norfolk

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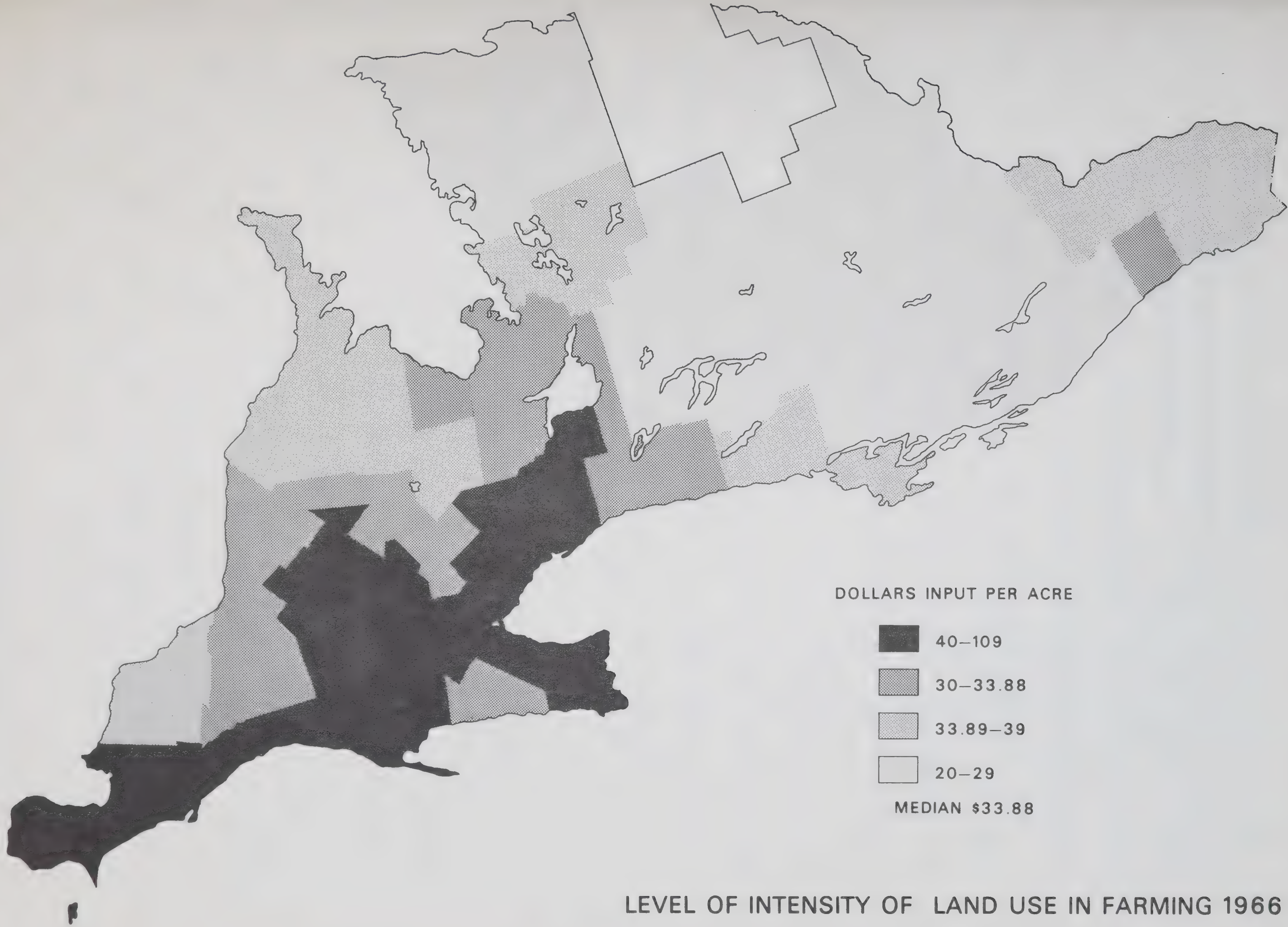
[1]The number of acres of land used in farming was measured by adding together the improved acres plus the "other unimproved" acres, ie. total acres in census farms less the acres of woodland on farms.

tobacco area, and in the special sites in the Niagara fruit area.

The highest levels of intensity are over $90 per acre in Norfolk and Lincoln, (see Figure 50), but there are eleven counties over $50 per acre in 1966. Ten of these counties form a contiguous zone from York County westwards around Lake Ontario, all of Niagara and westwards including Brant, Oxford, Norfolk and Elgin. The eleventh is Essex. This first tier surrounds the westward end of Lake Ontario plus an extension westwards. The next highest level of intensity from $40 to $49 includes only three counties: Waterloo, Perth and Kent, all of which are to the west and south of Toronto.

The third level of intensity, $30 to $39 includes a very large number of counties, twenty. The overall median for Southern Ontario is $33.88. Within this group of twenty, the eight which are above that median for Southern Ontario are all contiguous to those mentioned in the preceding paragraph (except for Dundas in the east). We thus find that the median demarcates a large solid zone enveloping all of the urban centres west of Oshawa. This zone starts in with Durham just east of Oshawa, extends to Simcoe north of Toronto, and includes all the area westward from Toronto to Lake Huron and south to Lake Erie, with the exception of Lambton, which itself was the median county. Still another tier is added when we examine the counties just under the median in the range $30.00 to $33.88. This level brings in Lambton, the Georgian Bay counties including Muskoka and most of the Lake Ontario shoreline. These form, in effect, the next layer slightly more distant from Toronto than those already included at higher intensities. In addition, the six eastern-most counties are in this range, perhaps indicating some urban influence from Montreal and Ottawa as well as the somewhat better soils east of Ottawa.



LEVEL OF INTENSITY OF LAND USE IN FARMING 1966

50

TABLE 37

Inputs per Acre of Land Used in Farming, 1966*

Range of Inputs ($ per acre)	Number of Counties
0 - 9	--
10 - 19	
20 - 29	11
30 - 39	20
40 - 49	3
50 - 59	7
60 - 69	2
70 - 79	--
80 - 89	--
90 - 99	1
100 - 109	1
($33.88	median)

*Land used in farming excludes woodland and is the improved land plus "other unimproved" land.

The lowest levels of intensity are entirely restricted to the large areas on the Precambrian Shield and its adjacent shallow limestone plains, with $20 to $29 of nonland inputs available for each acre. These very low average levels reflect the high proportion of the land in farms which is unimproved by cultivation and hence is incapable of profitably utilizing any significant quantity of labour and capital on each acre.

If only urban influences were important in intensity, the zone of high intensity would not extend as far west as Elgin and Norfolk. If only climate was important, Simcoe probably would not be included while Lambton would rate higher on this scale. If only Classes I, II and III soils were of importance we certainly would not find Norfolk at the top of the intensity scale. The relations are not simple but it appears that some important factors have been identified in this analysis, and their influence on the quantity of inputs which can profitably be employed in the production of food in Southern Ontario, and hence support a relatively keen demand by agriculture for land.

5. Changes in Intensity of Inputs Per Acre

There are a number of circumstances which can affect the real quantity of nonland inputs applied to each acre of land used for farming. The real quantity of inputs per acre may rise or it may fall. Because these inputs are of different kinds we must rely on estimates in current dollars, and our data are marked by the influence of price inflation. Thus, our estimates appear to indicate only increases, whereas in fact it is clear that in some and perhaps many cases the real intensity has decreased. It may be somewhat misleading to appear to stress growth only. The main emphasis should be on adjustment and changes of each area relative to others.

An area may have a slow rate of increase or decline in its

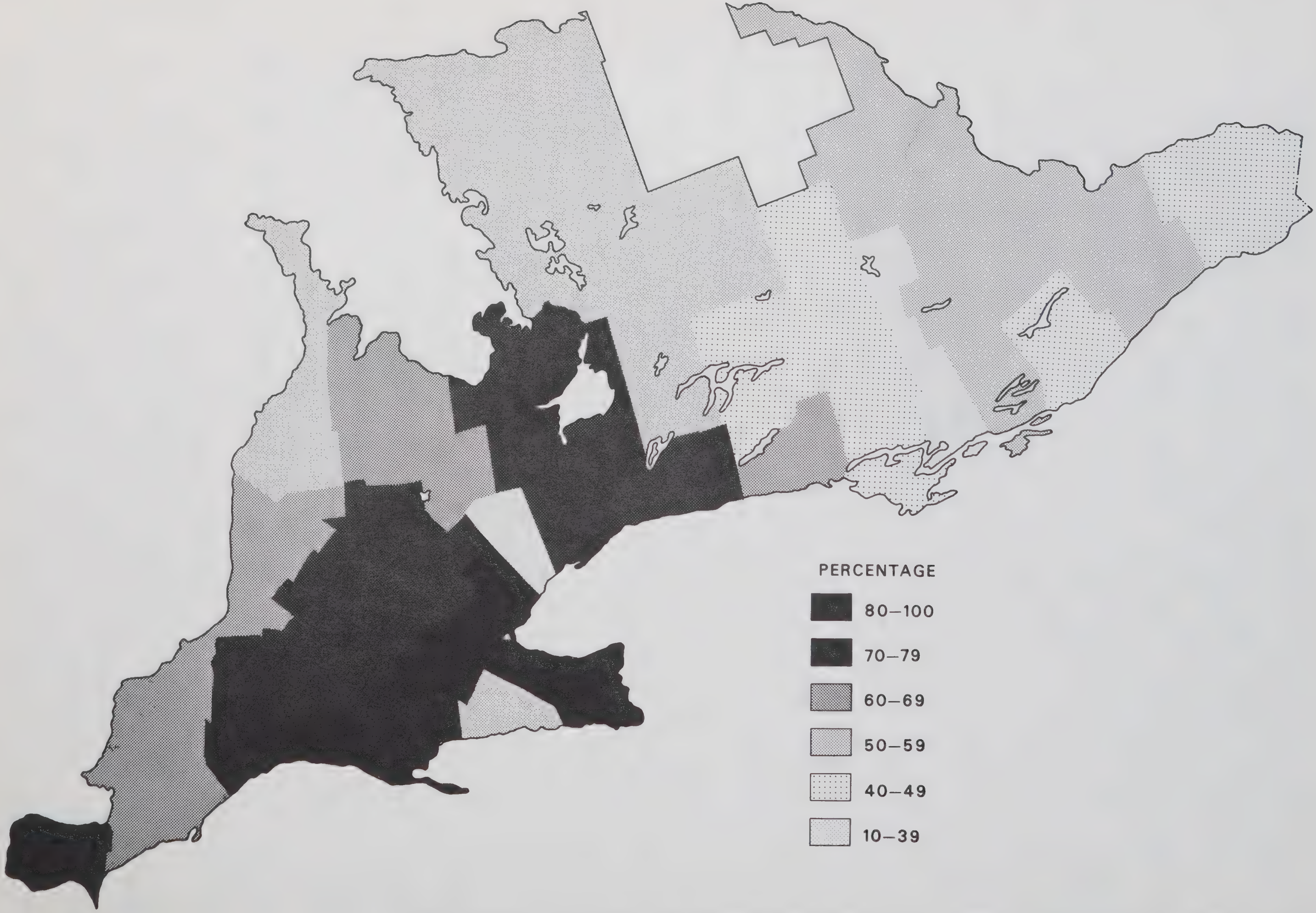
intensity if it is having to adjust downwards from an earlier position of a high level of intensity, or it may be further retrenching from an already low level of activity on the land. Even if intensity is falling, personal income generated per person or per farm may not be falling, and may in fact be rising if the adjustments are in the correct direction and sufficiently rapid, but it is clear that the total of personal incomes generated in an area will be falling wherever intensity is relatively declining, at least under foreseeable Ontario conditions. The basic reason for decreasing intensity is a lack of profit from the cost:output relation formerly existing, and in particular a low level of performance in the market when compared to competing areas.

Intensity may rise at a relatively rapid rate for several reasons. It may rise in an area where the land prices are high but the farms are not being converted to other land uses, and the land price is so high that an operator cannot profitably expand the farm business by buying more land. This forces him to expand the size of the business on each acre, so to speak, either by shifting to a different means of production or by shifting to an entirely different crop. Secondly, an area may increase intensity if it is able to increase its yield per acre at lower costs than the average costs in other areas, so that this area can capture a larger share of the market, thus justifying more inputs per acre. A third possibility is that there may be larger quantities demanded in the markets of those crops which are inherently more intensive kinds of enterprise, and consequently the area in which they are grown is expanding into the areas previously devoted to crops of lower intensity. This is particularly true of horticulture and of urban-oriented "amenity" agriculture such as riding horses, sod farms, and semi-recreational enterprises.

In more specific terms we would expect faster rates of increase in intensity in areas where we find one or more of the following conditions: 1) there is already some production of the intensive kinds of crops for which demand is rising, 2) there is superior access to urban markets, 3) there are favourable soils and climate, where the conditions are responsive to further inputs by increasing yields at little increase in cost per unit of output; 4) the soils and climatic conditions, and the farmer's management abilities, are versatile and adaptable to new techniques or to different crops than formerly grown, 5) there is an entrepreneurial attitude and willingness to innovate which responds to new opportunities, and there is a flow of information to signal the existence of the new opportunities (or the disappearance of old sources of profit, 6) there are high real estate prices at levels higher than the value which can be supported by agricultural use of the land.

(a) Analysis at the County level: It is clear that there are some areas of Ontario where none of the foregoing conditions exist, or where although some conditions would encourage improvement in farming other necessary conditions are not satisfied. The circumstances which permit or require intensification will vary from place to place. For example, urban pressure and high land prices will stimulate an increase in intensity, but so also does profitability, or good soils, or good market access. To illustrate, Elgin, Perth and Oxford were raising their intensity but none were under pressure from the urban land market nor under recreation pressure, and they all had increased acreages per farm.

Figure 51 shows the areas which between 1951 and 1966 had the ability to absorb more inputs per acre, and were actually absorbing more inputs; in addition it appears that they will continue to do so. There has been a strong urban-centred pattern in the past, which will



RELATIVE CHANGE IN INTENSITY OF LAND USE IN FARMING 1951–1966

51

continue. The zone of increasing intensity can be expected to broaden, and other areas will increase their intensity when future needs arise and the conditions warrant such action. The zone of higher intensity can be expected to expand toward Lake Huron, and further east along the north shore of Lake Ontario.

The data on the changes in the inputs per acre used for farming can be used to indicate areas in which farming displayed different degrees of economic health in the sense of viability. The measure of the percentage increase in current dollars per acre is strongly affected by the higher number of dollars attributed to labour on the farm. This increase in labour value reflects both inflation and a substantial rise in the average productivity of farm labour. The data appear to indicate higher levels of intensity in all areas in 1966 than in 1951, when in fact it is clearly known that in large areas farming was withering away. The percentage figures should more meaningfully be viewed as an index of economic viability of farming in Ontario, ranging from quite weak to very strong. The term "viability" is used in its literal sense of ability to continue life and growth, as an industry. It may be that "vigour" would be even more appropriate, because it is clear that in fact there are few counties or townships in which farming will completely die; some life may remain for decades in an area, but without any vigour. The very low rates of change in intensity per acre show a lack of vigour, but only rarely can it be said that the complete end is in sight for farming in an area. A lack of vigour tends to be correlated, however, with low and decreasing economic returns to land, labour and capital.

Viewing the rate of change in inputs per acre as an index of dynamic and healthy conditions for agricultural activity, the data on Figure 51 fall into four main groups or regions, each with a locational

identity. The highest rates of change are grouped in the range of 87% to 95%, with five counties clustered around the western end of Lake Ontario: Halton, Wentworth, Lincoln, Welland and Brant. These are not the most highly urbanized areas, but are under strong urban pressures and market opportunities. A larger group of twelve counties has distinctly lower indices of change, from 68% to 75% (a) immediately east of Toronto, (b) immediately west of Toronto, and (c) further west and south as far as London. These two groups constitute a solid zone from Durham County on the east circling north of Toronto and southwestwards to Perth and the Lake Erie shore. It is an envelope around the urban heart of Southern Ontario. A small third group have data in the lower 60's, and include Dufferin, Grey, Huron, and Kent, extending the larger zone to the west and south, further from the cities and on the warmer side.

The fourth group of counties had expenditures rise only 45% to 59%, probably so low as to be a retrenchment in real terms. The median for all Southern Ontario is 60%. The eighteen counties which are clustered below that median are all in the region east of the Belleville-Midland line except for Bruce and Haldimand. These two counties are too remote for urbanization yet to stimulate intensification and have some soils too unresponsive to justify intensification. The same conditions are true of the eastern counties, and in addition the climate and the management skills of farmers are unfavourable.

Peel County stands apart from all other counties. Its expenditures per acre changed only 11.5%; the next lowest was Lennox and Addington with 35.5%. Although it had favourable soils (except for its northern areas), climate, markets, and farmers, it was overwhelmed by the process of suburban fringe development and "rurban" country estates, coupled with areas of idyllic rolling hills more suited to snowmobiles than tractors

or dairy cows.

The relative (and real) reductions in intensity in the eastern areas are not simply matters of location alone. Many factors are involved and a number are interrelated to produce a downward spiral which has no foreseeable reversibility. There is no basis yet for believing that the agricultural potential of the eastern areas will be restored under different economic, technological and social circumstances, even though it has been changes in those circumstances which have reduced the economic potential in those areas. Nevertheless, there is a very real reserve physical potential in those regions which sometime might be stimulated to higher levels of agricultural intensity.

(b) Analysis at the township level: The small-area detail which is possible by using township data makes very clear that there are great complexities in interpreting the changes in the intensity of land use in agriculture. Agriculture, in the real world, exists under many kinds of circumstances, and the relationship of the land resource to the labour and capital resources can vary for different reasons.

The complexities of the relationships among the elements in agriculture are highlighted in Figure 52 and especially by the fact that vastly different areas display apparently similar rates of change in the intensity of use of farmland. Data at the township level complements the data already examined at the county level. It is valuable to examine changes in intensity by township because it reveals relationships which are masked by aggregation to the larger geographic unit.

On the map we see again the rapid intensification of farming near the urban centres on Lake Ontario, but we also see that a number of townships in the centre of the Shield area also had a rapid rise in the estimated value of the nonland inputs which existed on the land

used for farming. The explanation is quite simple and the data demonstrate the validity of the concept; these dark-shaded townships on the Shield did in fact have a relatively fast increase in the nonland resources per acre when those resources are valued at their average value or opportunity cost in Southern Ontario. In the case of these townships on the Shield, the increase in value of resources available (per acre) was completely attributable to the labour of the farm operator and family, net of his off-farm work. In these townships the labour resource is stranded, and in 1966 the manpower available per acre was approximately the same as it had been in 1951, while the current dollar cost which should be attached to those man-years had rised by almost 100%. The imputed value of that labour available on those farms had doubled, while the acreage remained the same. This is in contrast to almost every other part of Southern Ontario where two processes were taking place: (a) most farmers were increasing the acres per farm or increasing their output per acre, and (b) on average there was a substantial increase in the amount of the operator's time which was occupied by off-farm employment.

These few remote townships are almost unique in Southern Ontario. Out of the almost 500 townships in the study area, only 34 had the value per acre of imputed labour (operator and family, less off-farm work) rise by 90% or more from 1951 to 1966, a rate which means a virtually constant number of man-hours available per acre.[1] Of those 34 townships, 23 were on the Shield or the limestone plain and 17 of the 23 are in the class showing

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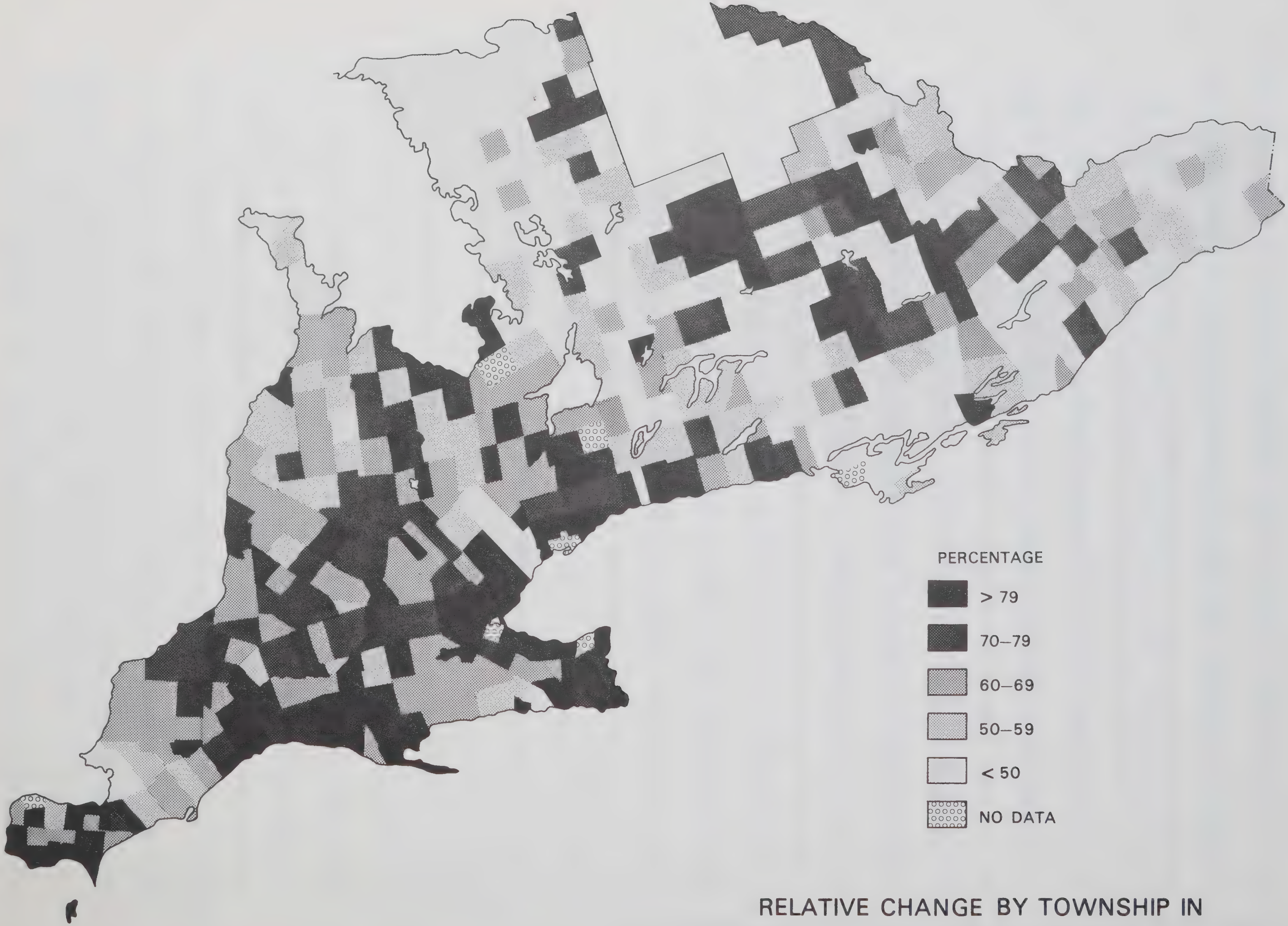
[1] If in 1966 there were the same number of acres per farm as in 1951 and no off-farm work at either date, the estimating formula would have the effect of increasing the imputed value of operator and family labour per acre by 112%.

the highest percent change in value of nonland inputs per acre, the darkest shading on Figure 52. The other 11 townships with this characteristic are in areas of intensive farming such as York, Wentworth and Lincoln.

These Shield townships were frustrated in almost every avenue of farm adjustment. They are remote, and most of the dark-shaded areas in the Shield are off the highways and at the ends of the roads. They are sparsely populated. There is almost no market for their land at prices which would finance retirement of the labour. They are under competition from areas with rapid rises in physical productivity of the land. There is almost no opportunity for off-farm work. These dark areas are very dismal indeed, as shown by the hopelessly inadequate adjustment in the relation between the human resource and the land resource. The net result was that these remote marginal areas were left in 1966 with almost as much labour available per acre of the land used in farming as there had been in 1951, and no means to raise the output per acre. Compared to other parts of Ontario there had indeed been a relative intensification of farming even though there should have been an adjustment to the extensive forms of farming.

The data on Figure 52 are dominated by two main features, which in some ways serve to add emphasis to the conclusions in the preceding sub-sections. On one hand there is the relative intensification of farming in the southwest, with a strong urban-centred relationship. On the other hand, in sharp contrast, there is the predominantly pale part of the map east of the Belleville-Midland line, with the rapid downward adjustment in the total size and intensity of the industry. The few dark blotches on the Shield, discussed in the preceding paragraphs, serve to sharpen the contrast with the general state of farming on most parts of the limestone plains and the Shield. The relative decrease in



RELATIVE CHANGE BY TOWNSHIP IN
INTENSITY OF LAND USE IN FARMING 1951–1966

intensity in the east appears to be a thoroughly rational and justified trend, and it is the means of sustaining the relative real incomes of the people who have remained within agriculture. It is evidence that the competitive advantages of the eastern areas have declined relative to other parts of Ontario. It is somewhat surprising to see that there appears to be no evidence of a positive effect from the urban centres of Ottawa and Montreal. This may be the result of several factors including:

1. the lack of an equivalent real estate market price escalation,
2. the sparser level of overall regional density of population,
3. the effect of the provincial boundary and the poor integration of the eastern counties in the Montreal economic system,
4. quality of soils and climate poorly suited to urban-oriented and amenity agriculture, and
5. the general lack of vigour in agriculture in the eastern regions.

The southwestern region reveals again the general pattern shown by the county data in Figure 51. The highest rates of intensification are found near the urban heart, and there are slower rates toward the Georgian Bay and Lake Huron periphery. There also is the evidence that agriculture is being inhibited in the areas closest to Toronto, especially in Peel County, which will be discussed later.

There are quite wide differences in various areas, and the explanations are not the same everywhere. Some features may appear to be anomalous, but can be explained. However, the important finding is that there are signs of a general inverse relationship with distance from Toronto - Hamilton and a direct but weaker relationship with soil qualities and climate.

Essex and Kent counties provide an interesting contrast. Essex shows a rapid intensification, while Kent had only a very slow rise in dollars per acre. Essex had a real intensification with rapid increases

in greenhouse and other horticultural enterprises. On the other hand, Kent took a different path during the period, perhaps largely due to soil differences. Both represent very high levels of economic returns to land, labour and capital in farming. Kent appears to be the extreme western edge of the urban-centred "mantle" over agriculture. It has no special advantages of soil or location. There is a relative lack of special horticultural crops except for the relatively extensive and mechanized vegetable processing crops. There already in 1951 was a high level of profitability, which has persisted, with the existing crops and techniques. The crops and soils were highly amenable to mechanization and large-scale operations. There was a lack of pressure from an urban land market. The sugar beet industry which used a lot of labour per acre had become more mechanized and had reduced its acreage from the 1950's through the 1960's (but still was substantial until 1967). There were no special reasons for intensification, and thus Kent maintained its position and became even more efficient in its specialty of producing cash crops.

Comparisons among individual townships are subject to difficulties and should not be attempted in isolation. The general patterns are important, not the details. Single events or single features may have an undue influence on small-area data but this does not negate the value of Figure 52.

Two relationships are especially valuable to explore in these data, the effect of closeness to Toronto, and the effect of special land market situations such as the Niagara Escarpment. It has been demonstrated that there appears to be a negative reaction within agriculture in areas adjacent to the suburban fringe, substantially in advance of direct urban

development or conversion of land uses. For somewhat similar reasons there is a general retrenchment of farming in areas which are attractive for outdoor recreation such as the Escarpment. The data in Figure 52 tend to support belief in these phenomena, and to delineate their extent.

Most of Peel County had real retrenchment in agriculture. There is a mixed picture here of course, because on one hand the greenhouse and nursery businesses expanded sharply (95% more greenhouse space and 190% more nursery acreage) while general farming appeared to shrink in all areas. The greenhouse and nursery expansion is the most intensive kind of agriculture but it is concentrated on tiny acreages. Furthermore, the greenhouse industry was revolutionized during 1951-1966 by vast reductions in labour requirements, in the order of 50% to 70% fewer manhours per square foot of glasshouse. Thus, Chingacousy Township in 1966 spent \$1.8 million less on hired labour (-60%) than it had in 1951 despite a 38% rise in greenhouse space (610,000 square feet) and 33% rise (9 acres) in nursery operations. In the same period, the Leamington area in Mersea Township in Essex County, increased greenhouse space from 1.4 million-square feet to 7.3 million square feet (+420%) but increased hired labour expenditure by only 200% despite doubled wage rates.

York County shows some of the same symptoms as Peel County, although to a lesser degree because the urban growth pressures tended to be far greater westward from Toronto than northward. This westward tendency arises partly because of the orientation of the road system and partly because of the strong tendency in North American cities to grow toward the west as wealth and new housing seek the cleaner fresher air of the prevailing westerly winds. York County had considerable increases in the very intensive kinds of farming represented by greenhouses and nurseries, but under major difficulties. The total county greenhouse space

increased by 80% to 2.8 million square feet while Peel increased by almost 100% to 4.4 million square feet. Nurseries in York grew only about 25% to 327 acres while Peel nurseries trebled to 381 acres. Greenhouse operations in York are almost entirely new since 1951, since the bulk of the 1951 greenhouses were in Etobiocoke, Vaughan and Scarborough townships and had virtually disappeared by 1966, with the new space added in King, Markham and other areas to the north.

Vaughan, Markham, King and Pickering townships appear on Figure 52 to display some of the relative decline in intensity which Peel suffered, but to a much smaller degree, during the period studied. This makes a complete ring of townships surrounding Metropolitan Toronto in which agriculture is not intensifying at the highest possible rates, which traditional theory would indicate, but appears to be adjusting downwards as the remaining farms prepare to be phased out. It is clear however, that this relative decline in the way in which farming is being conducted was occurring very much in advance of actual urban development of the land. These entire townships were apparently passing an opportunities for productive activities which were created by the nearby urban growth. It is clear, of course, that the productive activity took place in the next tier of townships somewhat further from the urban centres, as shown by the dark shading in many townships further north, east and west of Toronto. Soils in Vaughan, Markham, and Pickering are among the best, with over 75% of the soils being in Classes 1 to 3 for agriculture. It is to be noted that E. Whitby Township in which Oshawa is located had relative decline in intensity in contrast to its adjacent townships.

On Figure 52 there is a visual anomaly which creates the impression of a strong linear pattern of rapid increases in intensity between

Collingwood and Oshawa. It appears to be purely coincidence plus the geometric pattern which creates an almost unbroken line of dark-shaded townships north-westwards to Georgian Bay. The conditions appear not to share any common features. Collingwood and Nottawasaga Townships on Georgian Bay have expanding apple and potato enterprises. Essa had improved some land for potatoes. The vegetable operations in the Bradford and Holland Marsh areas provide a special situation, and the southern group of townships are those in which the urban influence has supported higher intensities. The apparent corridor pattern is only a sequence of differing special circumstances of soils, climate, access, although all benefit from being relatively close to the urban centres.

The Niagara Escarpment may have some effects on agriculture, judging from the evidence in these data. It appears that the slopes beneath the Escarpment to the east may offer opportunities for relative intensification, due to soils and micro-climate conditions. This is certainly true in Halton County where Burlington (Nelson) and Esquesing include part of the Escarpment but are largely below its lip. Somewhat further north, Albion and Adjala may have somewhat similar kinds of effect, and certainly this is true in Nottawasaga, Collingwood and St. Vincent along the Georgian Bay shore where the apple orchards owe their existence to the Escarpment and to the Bay climatic conditions.

On the other hand, townships which are on the Escarpment but are largely on the upland side appear to have considerably slower changes in intensity. An arc of eight townships share these characteristics: (from the north) Sydenham, Euphrasia, Melancthon, Osprey, Mulmur, Mono, Caledon and Erin. Each had the value of nonland inputs per acre rise by less than 60%, each had soils with less than 75% in classes 1 to 3, (except Osprey which is over 75%) and each includes a substantial area

on the upper level of the Escarpment. Some have substantial interest for extensive types of outdoor recreation and estate housing. There are few, if any, areas so close to Toronto (and west) with such low rates of intensification. Further study in detail is needed to confirm whether these are real relationships in the factors affecting agricultural land use in the vicinity of this strategic feature of Southern Ontario's landscape.

It is increasingly useful to pursue analysis of the economic relationships between the physical features of the country side and the decisions of current and future landowners. It is also vital to recognize that many of these relationships are influenced to a very high degree by general economic factors which have no connection with physical features, such as the strong influence of distance to major urban centres.

6. Labour Inputs in Relation to Land

In the age of mechanization of agriculture it may seem paradoxical to appeal to rapid increases in the expenditure on labour as evidence of good performance in farming. However, the data indicate that in fact it has been true that the more rapidly has the labour input been increased in farming the more progressive is the area. There are several factors involved in this situation.

On one hand it appears that the highest returns in many forms of farming are achieved with "two-man" or "three-man" operations, and that the optimum size of enterprise has been rising. On the other hand, the high price of land near large cities tends to encourage farmers to expand their business by intensifying on the land they already possess rather than expanding their land ownership. Although the price of labour tends to be higher near large cities, and labour is harder to

recruit, the data indicate a tendency to a relative rise in labour inputs in the more urbanized regions.[1]

The data on labour inputs are subject to a certain amount of potential misinterpretation because of the nature of the estimating technique which imposes on us the use of "current dollars" rather than inflation-free "constant dollars". It is of course absolutely obvious that agriculture in Ontario is reducing its use of man-hours of labour in total and per acre of land as the number of acres per farm increased and as tasks are mechanized; however, our measurements have had to be made in dollars while the price of labour approximately doubled from 1951 to 1966. The discussion which follows must be viewed as a comparison among different areas in terms of their different degrees of change. It is very probable that every one of these counties in Southern Ontario actually reduced its input of labour-hours per acre, but the important thing to observe is that some had to reduce labour at very rapid rates, while others were able to find profitable work for almost as many labour-hours per acre in 1966 as in 1951. In fact a number of counties were apparently able to justify even larger real inputs of hired labour per acre. This then is the purpose of the discussion, to compare those most dynamic areas with rapid rates of increase in dollar inputs of labour with the lagging areas which display only low rates of change.

Considering the estimated total input of labour, both hired and unpaid family labour, the median increase was 55 percent in current dollars. However, this is somewhat misleading because the distribution of the

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[1]The data do not include labour inputs provided in the form of purchased custom work. This may produce a downward bias in the estimates of the 1966 labour inputs in the cash crop areas in the extreme south-western counties.

counties is actually bimodal, with a group of counties clustered around the 40 to 49 percent range and another group clustered around the 60 to 69 percent range. The division goes deeper than being purely statistical, however; there is a clear distinction between the counties to the east and west of the line drawn from roughly Belleville to Midland (see Figure 53). The most rapid increases in labour expenditure are in the west. There is no doubt some influence of the large urban cities is pushing up farm wage rates, and hence cost per acre faster in the southwest, but there appears to be a much greater disparity than could be explained simply by faster wage inflation near cities than in the more remote areas.

Of the 12 counties in the group 40-49%, eleven are east of the Belleville-Midland line, while all of the 12 counties with increases of 60-69% are west of that line. In fact, all of the 22 counties above the median are west of that line except for Haliburton.

It is difficult to relate the change in dollar figures on labour inputs to actual hours of real labour input per acre. The only certain fact is the average wage for Ontario farm labour increased almost precisely 100% from 1951 to 1966, and that wage was computed to the labour of the farm operators and unpaid family help. It appears almost certain that every county actually was using fewer labour hours per acre per year in 1966 than in 1951, as mechanization advanced. However, many areas shifted from old crops or older ways of growing them toward different crops which would require more or less energy input per acre. The figures indicate that there was real intensification in the areas to the southwest, particularly near the large urban areas. Peel County increased its dollars of labour inputs per acre by 3.5% which surely indicates that the real labour input was decreased by over 50%.

The use of hired labour by farms is an indication of several

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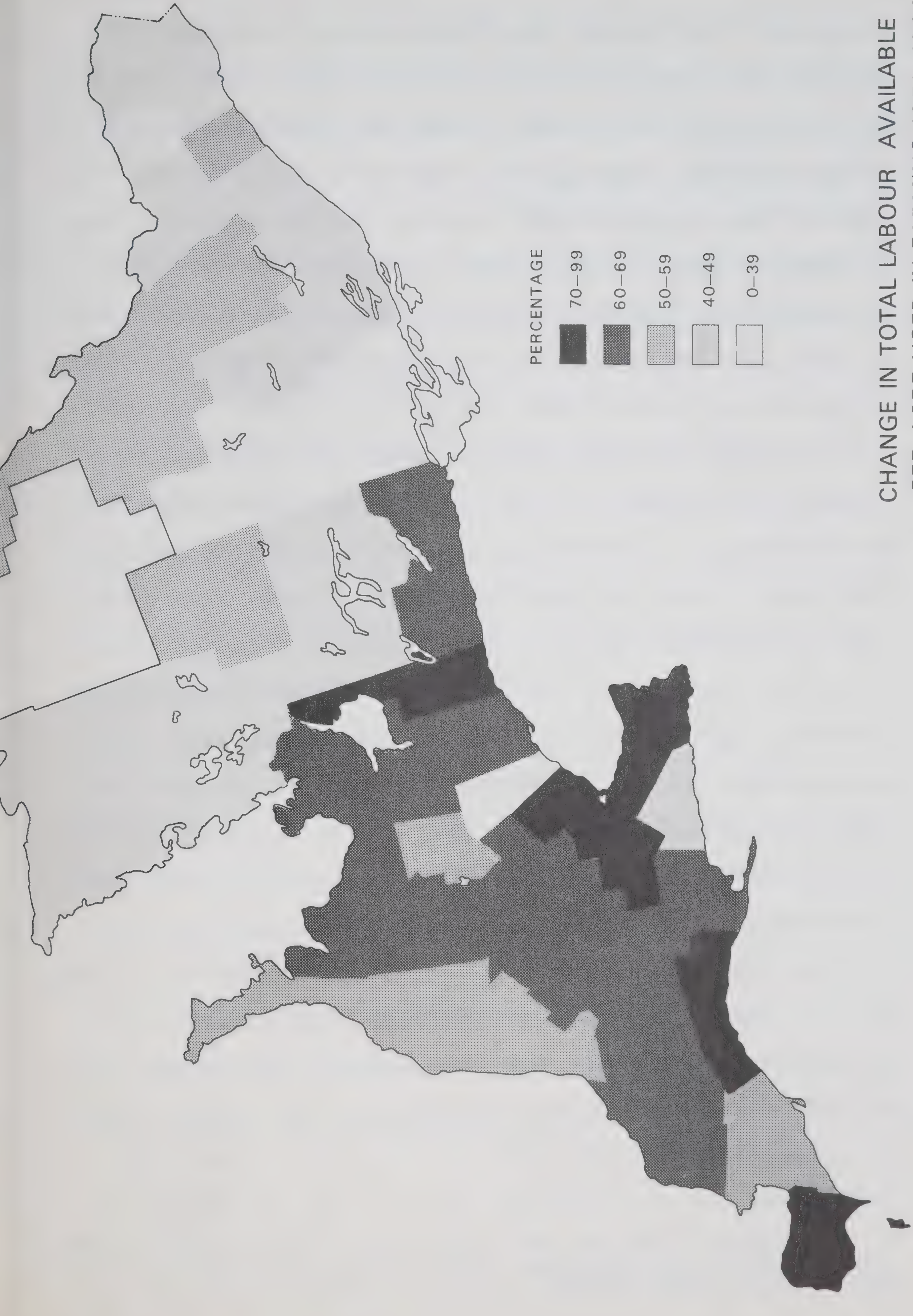

CHANGE IN TOTAL LABOUR AVAILABLE
PER ACRE USED IN FARMING 1951–1966

conditions. It may indicate highly labour-intensive operations in which there is no feasible machine substitute for hand-labour, such as much of horticulture and tobacco. It also may indicate the existence of large operations, requiring two or more men to perform the work involved. There is some tendency to consider that the presence of large operations indicates a profitable area, within which the most capable or fortunate farmers can achieve growth to larger sizes. Only if farms are achieving relatively high returns per man-hour can the farm afford to pay cash wages to hire labour.

If the use of hired labour is rapidly increasing in an area it would appear to indicate rising rates of return, especially if the use of hired labour is providing an increasing proportion of the total labour input. Twenty-two counties had a faster increase in the dollar value of hired labour inputs than their increase in the imputed value of the unpaid labour inputs. Fifteen of these had total labour inputs rise faster than the median, and eleven of them increased their dollar expenditure per acre by over 100% in this time period. Not one of the counties where total labour per acre changed by less than the median rate displayed a rise in hired labour per acre of more than 100%. Most of these with rapid increase in hired labour per acre were increasing it at more than twice the rate of increase in their imputed family labour per acre. These most rapid increases in hired labour per acre tend to be clustered around Toronto; nearness to the major cities appears to be more important than the presence of special crops such as horticulture and tobacco.[1]

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[1]Counties with more than 100% increase in hired labour expenditures per acre: Durham, Northumberland, Ontario, York, Simcoe, Halton, Wentworth, Brant, Welland, Elgin and Essex.

In conclusion it appears that the data on labour inputs per acre demonstrated a real intensification of agriculture in the counties close to urban centres. The tendency to intensification is partly a reflection of the high cost of land, but it is also a reflection of the higher demands for the more intensive forms of farming in which labour is still relatively unmechanized. There is strong evidence that the zone in which this high intensity is found is widening in broader circles around urban centres, extending further east and west. The highest levels of hired labour per acre in 1966 are to be found to the west and south of Toronto where 10 counties spent over $10.00 (and up to $50.00) per acre on hired labour.[1] The next highest levels of hired labour ($4.00 to $9.99) are found in a surrounding tier: Northumberland, Durham, Ontario, Simcoe, Waterloo, Middlesex, Kent. Carleton also had over $6.00 per acre, but all of the rest of Southern Ontario spent in 1966 less than $4.00 per acre on hired labour.

There is not a good correlation between the level in 1966 of labour input per acre and the 1951 - 1966 rate of change. Some areas such as Peel already were very intensive in 1951 and increased that intensity very little if at all. Others such as Northumberland started the period with very little hired labour but increased its use rapidly so as to supplement the farm family's own labour.

The analysis of labour inputs confirms the conventional wisdom that the more intensive forms of farming are found near urban centres. However, it is also clear that the zone of relatively high intensity is also influenced by the warmer climate west and south toward the shore of Lake Erie. The most rapid increases in intensity

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[1] In ascending order: Oxford, Wentworth, Essex, Peel, Elgin, York, Halton, Brant, Lincoln, Norfolk.

of use of labour are taking place by the recruitment of hired labour, rather than by splintering of farms so as to devote the family labour to fewer acres. There appears to be a strong gravitational attraction exerted by the major urban centres around the end of Lake Ontario which is influencing even the more stable counties east of Toronto as far as Northumberland. The zone of most active urban influence is broadening and agriculture is adjusting to meet the new opportunities.

At the same time as a number of counties are spending much more on labour per acre, and apparently actually using more hired man-hours on each acre, there are quite contrary trends in other parts of Ontario. East of the Belleville-Midland line every county and district increased its dollars of labour input by less than the median value of 55%.

There can be no doubt that this represents a smaller number of hours per acre, and is most likely to represent retrenchment of farming back toward extensive forms of production which rely more heavily on the natural flow of energy and less on active manipulation of the land. Such retrenchment takes place in areas where relatively higher costs and/or lower yields press the returns per acre and per man-hour downward below the acceptable levels. This also indicates a "land-bank" of a kind, a reserve capacity for future increases in the intensity of production. However, such future re-conversion may be at considerable expense for land improvement or it may be forestalled completely if the land is irreversibly converted into other uses.

CHAPTER 5

AGRICULTURAL LAND VALUES

The price formation of land is a complicated matter. Land price should reflect the capitalized value of the future stream of income accruing to the production factor land. This future stream of income is not necessarily associated with its present use. If one expects the use to change in the future, then this will likely be reflected in the value of land. In the transition zones where agricultural land has been converted into urban or recreational use or is expected to be so converted in the future, land values will reflect these changes or expected changes. These complications should be kept in mind when interpreting agricultural land values.

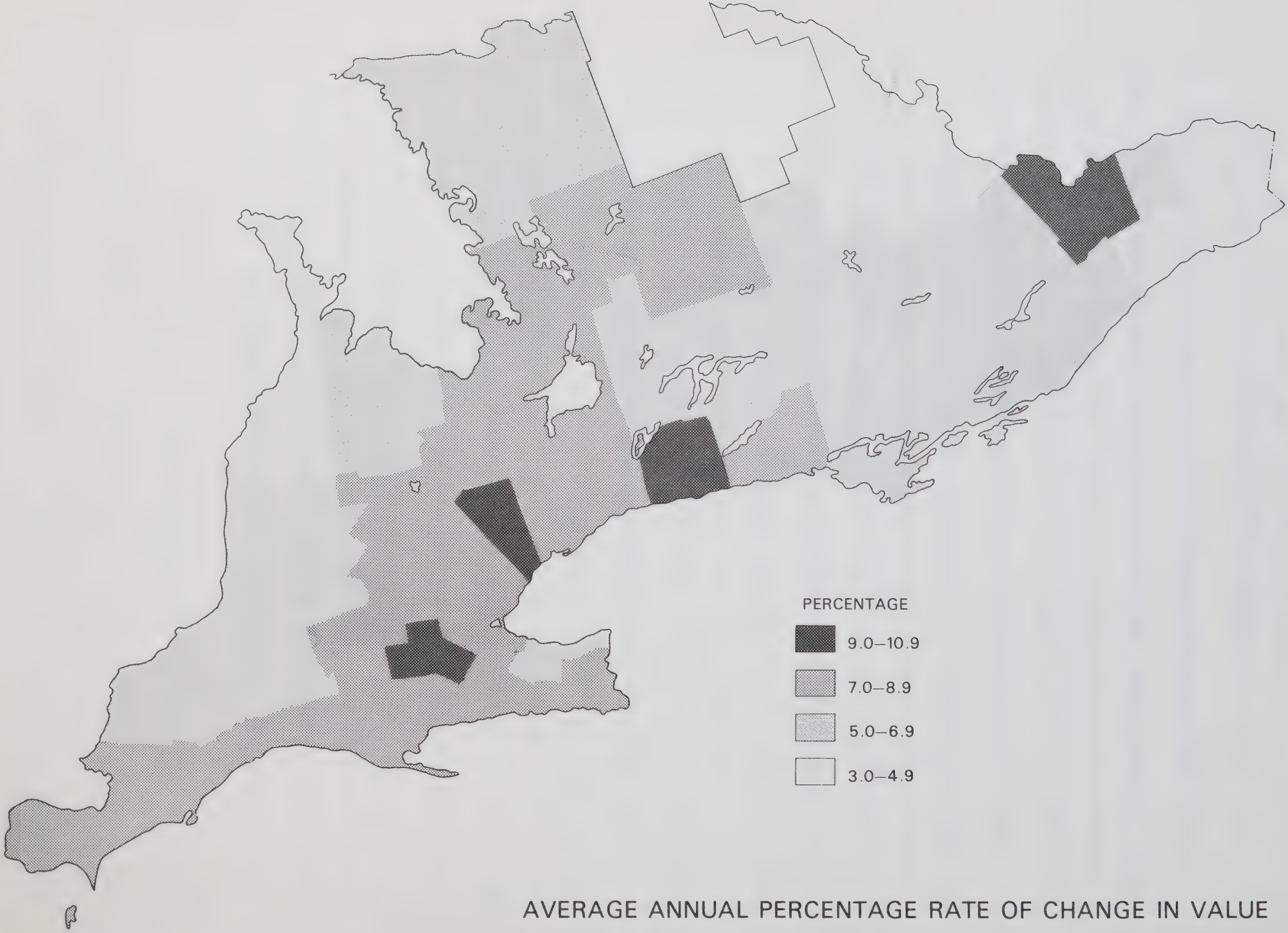
Two sources of land value data are available for the study area:

1. Census data for values of land and buildings in 1951, 1961 and 1966, and
2. Sales data for land only from the Assessment Branch of the Department of Municipal Affairs in the period 1967-1970.

The first source covers all townships and counties in the Province, while the second source excludes the counties of Halton, Peel, York, Ontario, Muskoka, Parry Sound and Haliburton. Sales data were not available for all townships of the counties included.

VALUE OF LAND AND BUILDINGS (CENSUS DATA)

According to the enumeration manual (1961), the value reported should be the market value as agricultural property. It is explicitly stated that real estate values near cities should not be reported, but



AVERAGE ANNUAL PERCENTAGE RATE OF CHANGE IN VALUE OF LAND AND BUILDINGS PER ACRE OF FARMLAND 1951–1961

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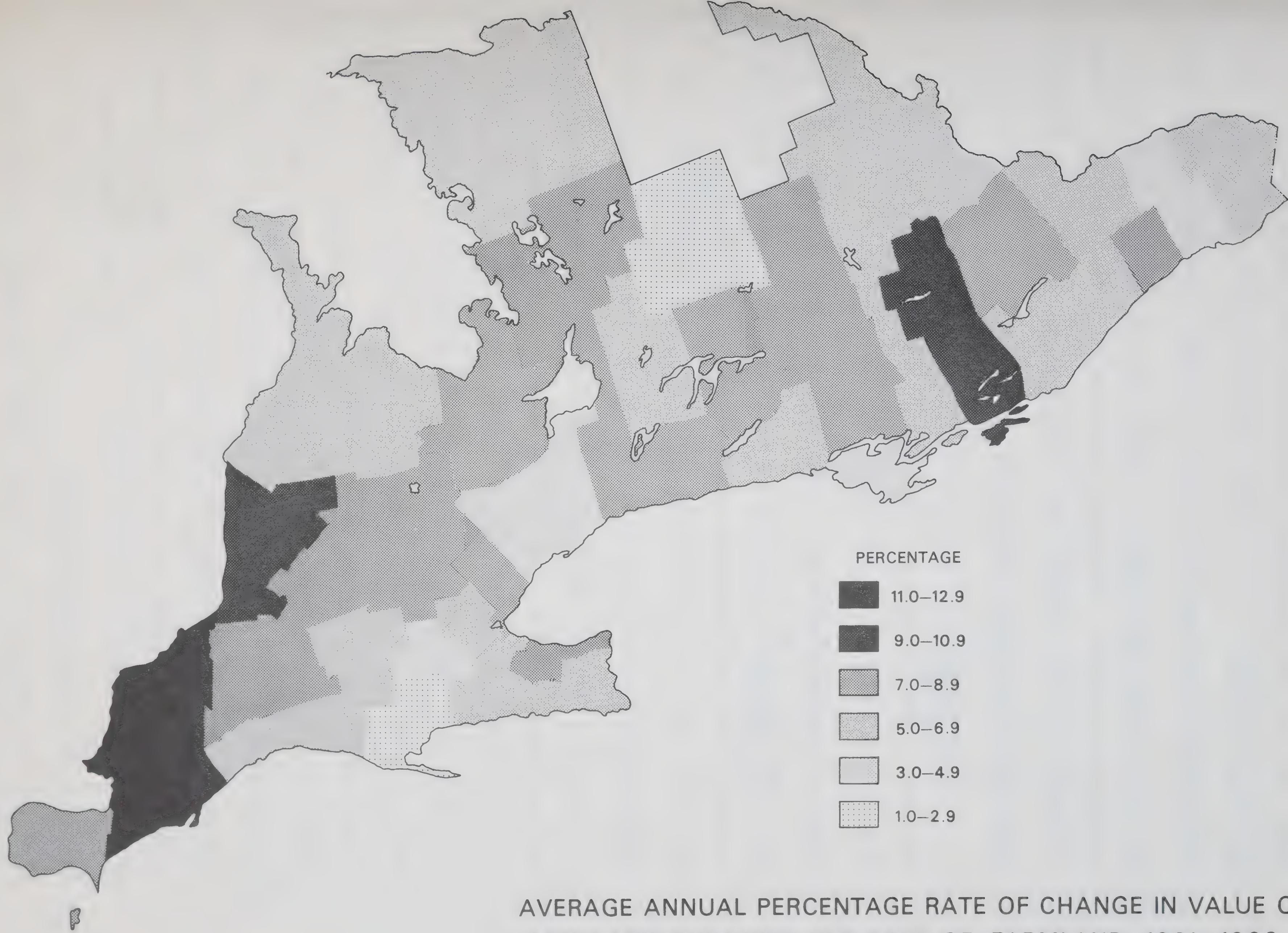


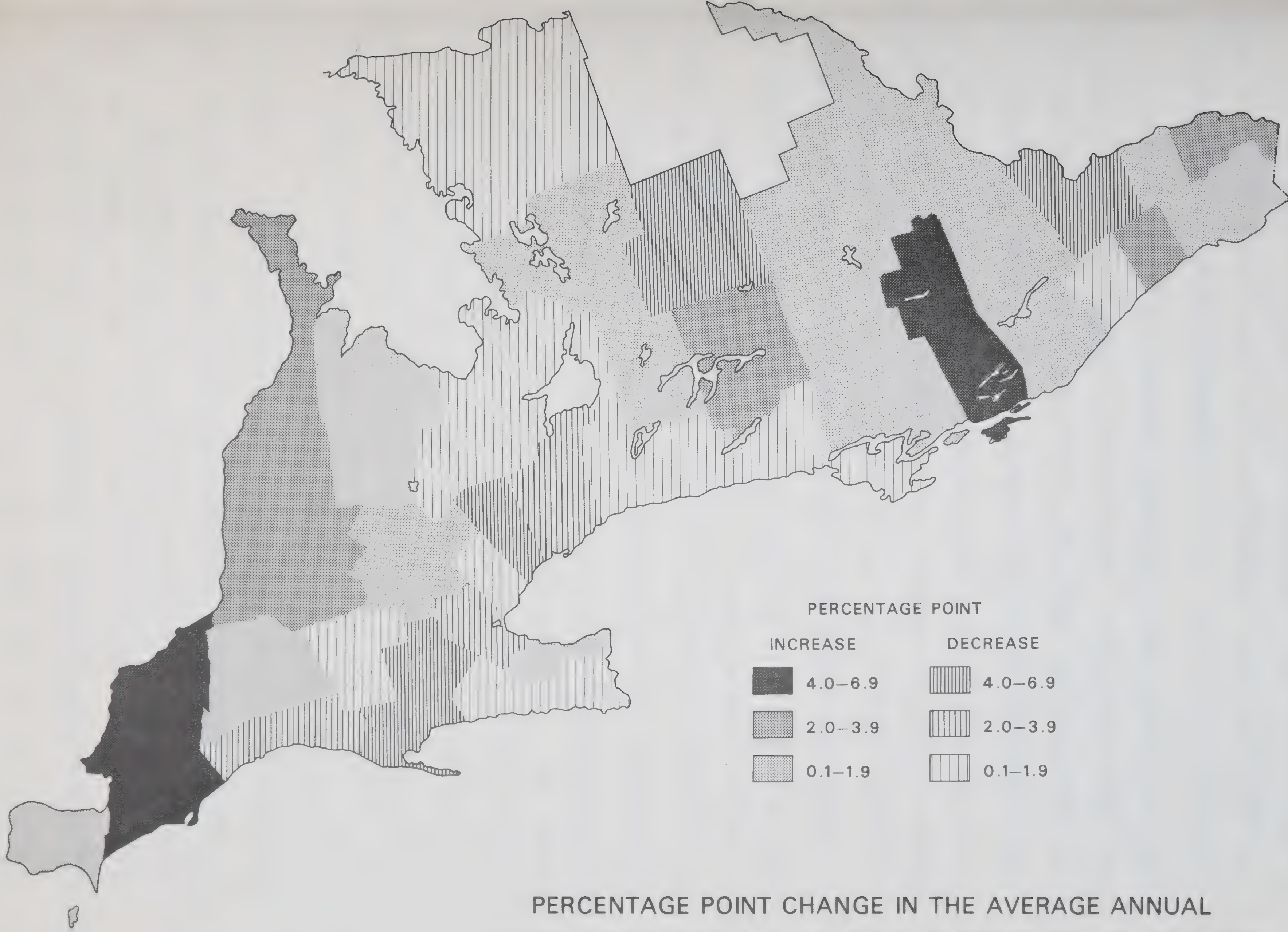
AVERAGE ANNUAL PERCENTAGE RATE OF CHANGE IN VALUE OF LAND AND BUILDINGS PER ACRE OF FARMLAND 1961–1966

55

rather the value of the property when used for the production of agricultural products. It is obvious that expectations about future changes do not occur only near cities. In other words, it is difficult to obtain a value which properly reflects its use for the production of agricultural products. Admittedly, areas not affected by the transition of agricultural land to other uses or expectations about future changes, reflect more closely the agricultural use value.

The absolute values of farm real estate per acre derived from the census figures are not too important for this study, since we have a better measure from the actual sales data, which are more recent and exclude the value of buildings. The census data are important for comparisons over time. Figures 54 and 55 indicate the annual percentage increase in farm real estate value per acre in the periods 1951-1961 and 1961-1966. There exists a fairly regular pattern of land value change between 1951 and 1961. Most counties in the central and southern part near Lake Erie show an annual increase of 7 to 9 percent, except Brant, Peel, Durham and Lincoln. Land values in the first three counties increased by 9 to 11 percent, while Lincoln showed a 5 to 7 percent increase. The counties in the western part and on the Shield showed an annual increase of land values from 5 to 7 percent, while on the periphery, in the counties of Bruce, Renfrew, Prescott, Dundas, Stormont and Glengarry, the annual increase was from 3 to 5 percent. The picture between 1961 and 1966 is somewhat different, as indicated by Figure 55. The increase in land values is partly caused by the fact that the relative loss of farmland is greater for unimproved land then for improved land. The land remaining in agriculture is then of a higher quality than in the previous period, and hence land values will be higher.

The comparison of absolute growth rates among counties gives



PERCENTAGE POINT CHANGE IN THE AVERAGE ANNUAL GROWTH RATE OF FARM LAND AND BUILDINGS VALUES PER ACRE OF FARMLAND BETWEEN THE PERIODS 1951-1961 AND 1961-1966 56

an indication of the relative improvement in comparative advantage of one county over another, assuming that land values reflect capitalized rent generated by agriculture. Figure 54 indicates the annual growth rates in farm real estate value in the period 1951-1961. It shows a pronounced more rapid rate of growth in the central and southern counties bordering Lake Erie than in the remaining part of the study area. The western counties and most of the Shield counties grew at an equal rate, while the most eastern counties showed the slowest rate of increase. The picture in the period 1961-1966 is somewhat different, as Figure 55 indicates. The absolute growth rates tend to be higher in the western counties than in the more southerly counties near Lake Erie. On the whole, the growth rates below the Shield are higher than those above the Shield. These figures are in accordance with the intensity data of farm land use. Agriculture below the Shield is more intensified, and increases its intensity level at a faster rate than that above the Shield. Hence, income generated from the land increases at a faster rate. However, a comparison in the second period indicates that land values in the southern counties near Lake Erie showed the same growth rate as in eastern Ontario. This would indicate that the improvement in the comparative advantage between these eastern and southern counties has become equal.

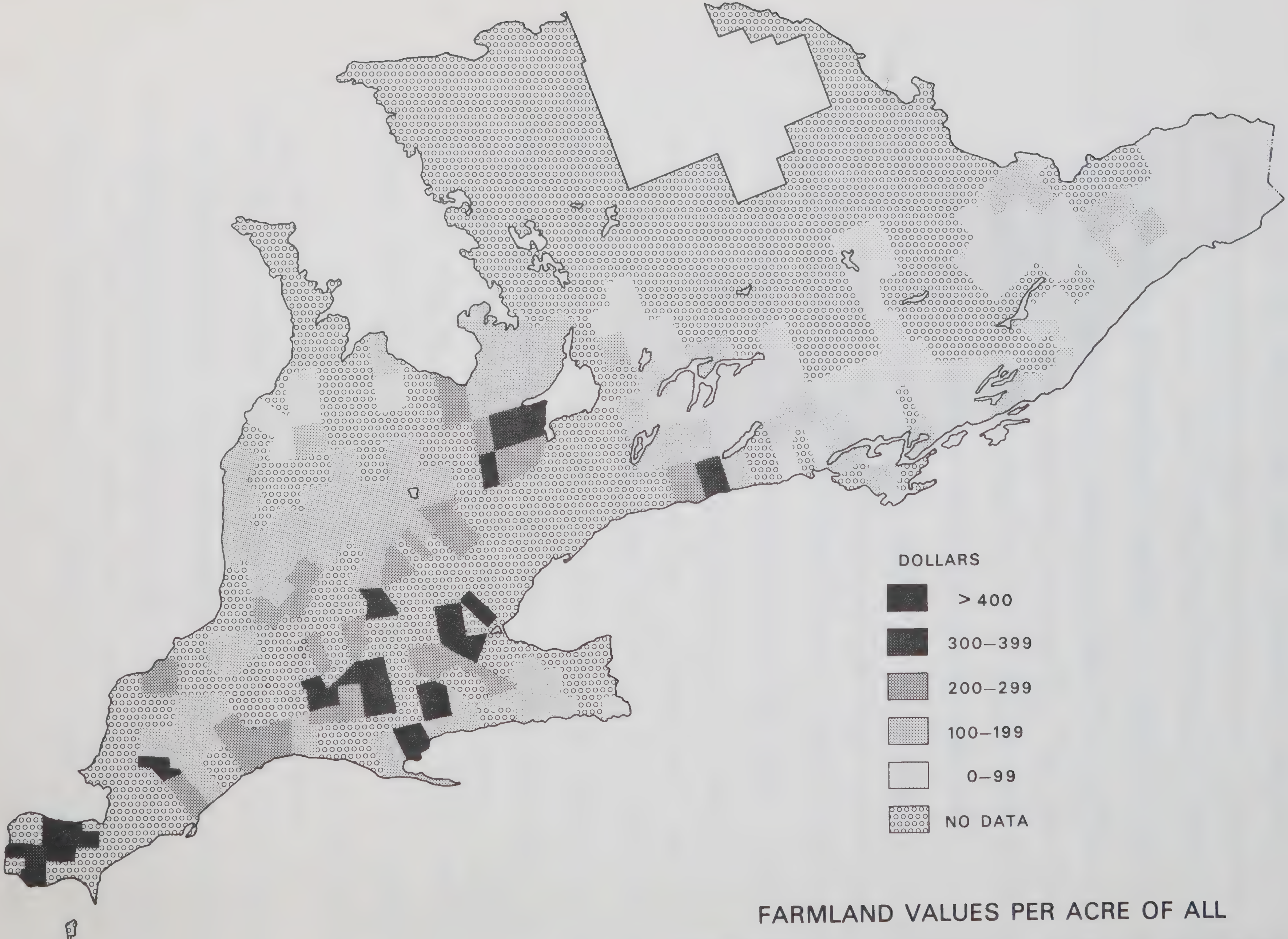
Figure 56 portrays the difference in percentage point growth between the two periods. It shows by how many percentage points land values grew more quickly or more slowly in 1961-1966 than in 1951-1961. According to Figure 56 , land values grew more quickly in the second period than in the first period in the western and southwestern part of the study area, in the Shield counties and in eastern Ontario. The southern and central part of the area showed a decline in growth rates. In other words, the areas under urban pressure in central Ontario and

Carleton showed declining growth rates in agricultural land values while the agricultural areas in western and eastern Ontario and in the Shield counties showed an increasing growth rate.

It is difficult to interpret these changes in growth rates. One may hypothesize that much of the speculation in the urban counties occurred before 1961. On the other hand, land values may have been so much out of line with agricultural use values by 1966, that farmers reported a lower value than prevailing market prices. However, for Oxford, Elgin, Norfolk, and Haldimand, this explanation is not satisfactory. The rapid decline in growth rate in Norfolk and Brant counties of around 6.5 percentage points is probably explained by the special crops grown in this area. Land values due to tobacco rights were already high in 1961.

The increase in growth rates in the Shield counties is likely caused, among other things, by the influence of purchases by nonfarmers. The fairly consistent increase in growth rates in the western and eastern part of the study area might indicate an improvement of the earning capacity of the land. Technological change which improves yields per acre, explains part of it. The western and eastern parts are also the areas where farm enlargement has occurred to a greater extent than in the more centrally placed areas. Land purchases for farm amalgamation will usually have an upward effect on values.

From these maps one may draw the conclusion that land below the Shield is gaining in importance for agriculture at a faster rate than that in the eastern counties, although the eastern counties are gaining in the second period while the urbanized counties and the counties near Lake Erie seem to lose some of their relative advantage. Land in the Shield counties seems to gain, probably as a consequence of land purchases by nonfarmers.



FARMLAND VALUES PER ACRE OF ALL
FARMLAND BY TOWNSHIP — AVERAGE 1967-1970

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VALUE OF LAND (SALES DATA)

The sales data provided by the Department of Municipal Affairs[1] include the total sale price, the total acreage transferred, location, year of sale, and the productivity points. All land is rated for use in agriculture. The highest possible rank is 100 points per acre. For each deficiency as compared to the highest quality soil, a certain number of points is deducted. This results in a grading system from 0 to 100 points per acre, corresponding to the quality of the soil for agricultural purposes. The ranking according to productivity points corresponds closely to the soil classification of the Canada Land Inventory. Soil class 1 corresponds to 85 to 100 points, class 2 ranks from 70-80, class 3 from 55-65, class 4 from 40-50, class 5 from 25-35, class 6 from 10 to 20, and class 7 below 10 points.

For the sales data west of the southern Shield border woodlots and bushland were not rated, except for Simcoe county. The value and acreage of the wood and bush lands in this area were indicated in the original data source and these values and acres were deducted from the sales price and the total acreage transferred in order to make them comparable with the productivity points. For the counties east of the Shield border all land was rated, including bushland and woodlots, except for Russell and Prescott. For these latter two townships the same procedure was followed as described above for the western counties.

Figure 57 shows the value of farmland per acre per township of all land (bush and woodland included west of the Shield border). The values per township are obtained by adding all farm sales in the respective

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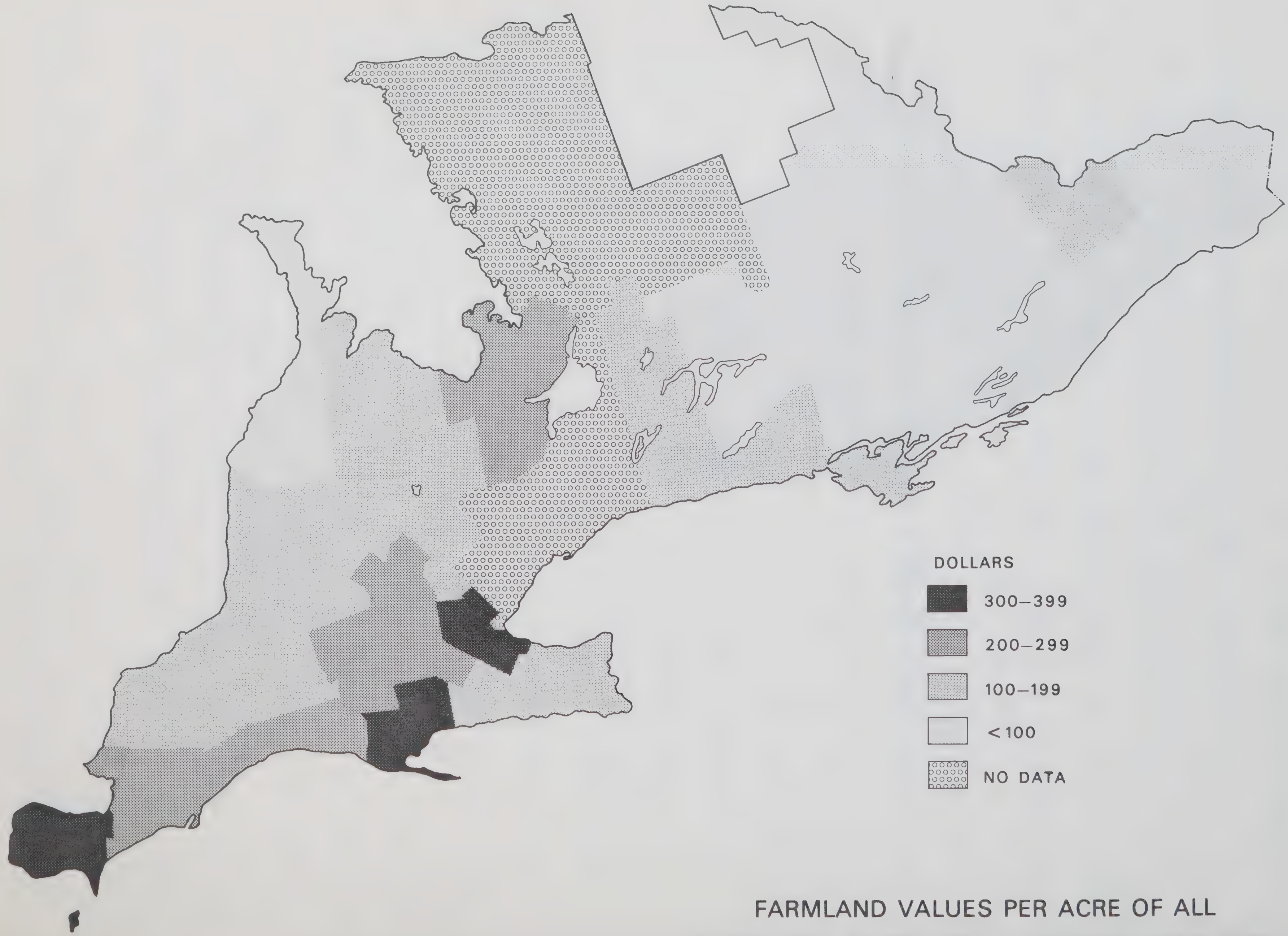
[1]We are much indebted to Mr. T. R. Hunter of the Assessment Branch of the Department of Municipal Affairs, Toronto, for the valuable assistance rendered in putting the data into a usable form.



FARMLAND VALUES PER ACRE OF ALL
FARMLAND BY COUNTY — AVERAGE 1967- 1970

58

township and dividing it by total acreage sold. Figure 58 provides the same information per county. The county values are obtained by the same method used for the townships.

Comparison of the land values in the different parts of the Province, as portrayed by Figure 58, gives the following results. Land on and east of the Shield has a considerably lower value per acre than land west of the Shield border. The most southerly-located counties show the highest land values. The difference in land values between the counties Lambton, Middlesex, Perth, Wellington and Dufferin in the west and most of the eastern counties amounts to roughly $100 per acre. This difference increases if the eastern counties are compared with some more southerly-located counties, such as Kent, Elgin and Brant. The difference in land values here amounts to $150 per acre.

How can one interpret these differences in absolute land values? The difficulty is that one must know whether or not these values are completely determined within agriculture. Although the data contain only farm-to-farm sales, this is no proof that all speculation on future land-use change is excluded. Farmers can be speculators as well. However, since the four counties around Toronto, where most of the urban pressure exists, are excluded, and the sales represent only farm-to-farm sales, it does not seem too unreasonable to assume that the largest portion of the values originated within agriculture. Having provisionally made this assumption, what does the difference in land values indicate? Compare, for example, land values in Russell and Oxford counties. The value in the latter county is 3.3 times as large as in the former, according to Table 38. Theoretically, it would mean that rent earned on an acre of land in Oxford is 3.3 times as much as rent earned on an acre of land in Russell County. Obviously this would mean that land in Oxford county is more

TABLE 38

Average Land Values By County 1967-1970*

County	Value Per Acre (dollars)
Brant	232
Bruce	99
Carleton	106
Dufferin	162
Dundas	85
Durham	150
Elgin	214
Essex	371
Frontenac	84
Glengarry	62
Grenville	49
Grey	104
Haldimand	169
Hastings	66
Huron	133
Kent	213
Lambton	173
Lanark	46
Leeds	52
Lennox and Addington	49
Lincoln	176
Middlesex	159
Norfolk	315
Northumberland	120
Oxford	291
Perth	186
Peterborough	86
Prescott	71
Prince Edward	112
Renfrew	73
Russell	88
Simcoe	216
Stormont	55
Victoria	101
Waterloo	261
Welland	157
Wellington	170
Wentworth	338

*Value of buildings excluded.

SOURCE: Computed from data provided by the Assessment Branch, Department of Municipal Affairs, Toronto.

valuable to society.

One must bear in mind, however, that these values mainly reflect current conditions within agriculture, and to a much lesser extent potential conditions. In other words, impediments may exist which cause land not to yield its optimum contribution (optimum rent). The impediments can be different in nature, such as a non-optimal combination of production factors. For example, the farm size may be inadequate, the lack of sufficient credit may hamper the introduction of new technologies and the management capacity may be low. If such impediments were abolished, the returns to land might change considerably. The above mentioned factors usually have a downward effect on land values. Other impediments may have an upward effect on land values, such as a heavy population pressure within agriculture. If pressure exists to expand farms, but not enough farmers leave the industry and hence not sufficient land for farm enlargement becomes available, then the scarcity of land on the market drives prices up. This research has not identified to any degree what the impediments are and where they exist. However, there seems to be some evidence that management skills in eastern Ontario are lower than in western Ontario. Another factor which can exert a heavy upward pressure on land value is the demand for land by farmers with high purchasing power relocating from the urban fringe. This force may occur especially in the western counties.

It is obvious that the comparison of areas on the basis of land values is difficult even under the not completely realistic assumption that the values are created wholly within agriculture. Still, a comparison is often necessary in land-use planning. As was indicated before, lands which earn a higher rent contribute more to provincial or national income than lands earning low rents. They also are likely to

yield a higher output per acre, a consideration which may be important for future food requirements. However, it does not mean that some of these high-yielding soils cannot earn a higher rent in an alternative use outside agriculture (for example, urban-industrial use) and hence contribute even more to provincial income.

Although high yielding land is more beneficial to society than low yielding land, this does not mean that farm incomes (excluding land rents) should depend on land quality. In a truly competitive situation and with adequate mobility of labour and capital, any farmer should be able to earn the same return per day of work and the same percentage return on his investment in machinery and livestock, if he has adjusted to use the currently optimal combination of production factors. However, the return to the land itself would be different. If all production costs other than land costs (farm labour, management and non-land capital included) are deducted from the revenues obtained from farm product sales, the net return to the land is obtained and net returns per acre will differ among soil qualities. This net return is the rent generated by agriculture and land values (for use in farming) are merely the capitalized values of these rents. The equality of the returns to labour and capital on different soil types depends on the full adjustment of the different enterprises within agriculture, as well as of the industry within the whole economy. Moreover, differences in the quality of farm labour and management may result in different returns. Different returns may also be caused by unemployment or underemployment of resources. Depending on the type of farming, an optimal combination of production factors frequently requires farms on lower quality land to be larger than on high quality land. An optimal combination of production factors in a well adjusted agriculture is a long-run phenomenon. In the

short-run, distortions may exist, invalidating the proposition that similar returns to labour and capital can be obtained on different soil qualities.

THE RELATIONSHIP BETWEEN LAND VALUES AND PRODUCTIVITY POINTS

Since difficulties in comparing land values among different areas are encountered, the question can be raised whether or not the productivity points could be used as a substitute in comparing the importance of land for agriculture in the different areas. If this were so, the land value interpretation problem in those areas is also eliminated where these values are affected by nonagricultural forces. The difficulty, however, is that these points must still be related to value in order to find out what their relationship is with the rent-producing capacity of the soil.

The relationship between the value per acre and the points per acre is tested in a regression equation. This computation attempts to find out how closely a variation in land values per acre among farms corresponds with a variation in points per acre among the same farms. In other words, from farm to farm the points per acre differ. The question now is, does an increase in points per acre accompany a corresponding increase in land value per acre? One of the underlying assumptions is that land values originate within agriculture.

For each county a regression analysis was performed. The results are recorded in Table 39. The more closely the change in points per acre adheres to the change in value per acre, the higher is the percentage of land price variation explained by the point system. The first column in Table 39 indicates how reliable the regression coefficient is. A probability level of one percent means that if the same analysis

TABLE 39

Percentage of Land Price Variation per Acre Explained by Number of Points per Acre and Probability Level of Regression Coefficient Attached to Points per Acre per County.

County Name	Prob. Level of regression coefficient	Percentage of Land Price Variation Explained by Point System
Bruce		
Dufferin		
Durham		
Haldimand		
Lincoln		insignificant
Waterloo		
Welland		
Wentworth		
Lambton	.01	
Northumberland	.10	
Peterborough	.01	9 - 19%
Russell	.05	
Simcoe	.01	
Essex	.05	
Frontenac	.01	
Glengarry	.05	20 - 29%
Oxford	.01	
Perth	.01	
Wellington	.01	
Middlesex	.01	30 - 39%
Carleton	.01	
Dundas	.01	
Grenville	.02	40 - 49%
Hastings	.02	
Brant	.05	
Huron	.01	
Kent	.01	
Norfolk	.01	50 - 59%
Renfrew	.01	
Stormont	.01	

TABLE 39 Continued.

County Name	Prob. Level of regression coefficient	Percentage of Land Price Variation Explained by Point System
Grey	.01	
Prescott	.01	
Prince Edward	.01	60 - 69%
Victoria	.01	
Lanark	.01	70 - 79%
Lennox & Addington	.01	
Elgin	.01	
Leeds	.01	80 - 89%

were performed many times, each time with a different sample of the same farms, the same regression coefficient would result in 99 percent of the cases.

No relationship whatsoever seems to exist between land values and points per acre in a number of counties, as the first grouping in Table 39 indicates . The number of observations in most of these counties was small, except for Bruce and Dufferin. This has an effect on the significance level.

Although the points are not able to explain the full variation in land values, a highly significant relationship exists between land value per acre and number of points per acre in the majority of the counties. For certain counties, variation in land quality (variation in points) explains only a small proportion of the variation in land value, while for Elgin and Leeds almost the whole variation in land values among farms is explained by soil quality.

Although no significant geographic pattern exists of how well soil quality affects land value, it seems that, on the whole, the explanatory power of soil quality on land value is lower in the counties west of the southern Shield border than east of this border. Exceptions are Elgin and Grey counties, followed by Brant, Norfolk, Huron and Kent. The soil quality in the remaining western counties explains less than 40 percent of the price variations among farms.

Where soil quality does not fully explain land price variation, more forces are exerting an influence on land value. These forces could be either external to agriculture, such as urbanization and recreation pressures, or internal. The latter would be the case if rent were determined by forces other than soil quality, such as climate, proximity to markets, etc. It is also questionable whether the same quality land

yields exactly the same output in different areas, although within a county this probability is much higher. The results from Table 39 do indicate that farmer-buyers definitely look to soil quality and that the quality is taken into account in the purchase price. However, since the explanatory power of the point system is rather low in many counties, the points are not a perfect substitute for land values in comparing the importance of the general value of land for agriculture, unless one assumes that the unexplained part of the price variation is caused entirely by forces external to agriculture. This assumption seems highly unlikely, given the high probability level of the regression coefficient attached to the points per acre. If the urban pressures were that strong, one cannot imagine that soil class 1 land would sell at a premium compared with soil class 3 land. However, no conclusive test exists unless the regression equation contains all relevant variables.

The comparison of the earning capacity of land in different parts of the Province is of at least equal importance for land use planning than a comparison within a county. For that reason, the same regression equation was performed for each economic region in the study area. The regression coefficient attached to points per acre was in all instances significant at the one percent probability level. The explanatory power of the point system, however, dropped considerably and ranged from 7 percent in the Georgian Bay Region to 38 percent in the Lake Erie Region. The outcome indicates that soil quality has a definite relationship with land values, but in all instances considerably more than half of the price variation in land values per acre cannot be explained by the different soil qualities. Proximity to markets and climate differences are likely to play a more significant impact on the regional than on the county level. If one compares greater areas, it becomes more

difficult to use the point system as a substitute for land values in comparing the importance of agricultural land for society in the different areas.

A higher soil quality is definitely superior to a lower quality, given that all other factors affecting land value remain constant. However, these factors do not remain constant, not even at the county level. Otherwise, they would have appeared in the constant term of the regression equation and the explanatory power of the soil quality would have been greater. The superiority of the higher soil classes to the lower classes is supposedly explained by the fact that the output-input ratio on high class soils is higher than on lower grade soils. In other words, a unit of output produced on soil class 1 would require less inputs than the same unit produced on soil class 2. This means that society would use fewer inputs to produce a certain amount of food on high quality land as compared to producing the same quantity on low quality land. However, the output-input ratio on soil class 2 in a favourable climatic zone may be higher than the output-input ratio on soil class 1 in a less favourable zone. The distance factor may have a similar effect. The fewer inputs used per unit of output on soil class 1 as compared to class 2 may be more than offset by the additional inputs needed to ship the product to the commercial markets if the location of soil class 1 is farther from the markets than soil class 2 lands. There could be many more factors affecting land value, not necessarily related to soil quality. In different climate zones different products are raised and technological change usually differs among products. This again would affect land values.

The smaller the area, the more one expects factors such as climate and proximity from markets to be constant. One does not expect

a large variation of these factors within most counties. Nevertheless, soil quality explains only a relatively small proportion of the total price variation in many counties. This suggests that more factors other than climate and distance, affect land values. External factors such as urbanization and recreation pressure may exert some influence, although as was indicated before, the effect is not expected to be large. All these factors affecting land value, except the external pressures, are important for comparing the agricultural performance in the different areas of the Province and even within a county. The conclusion drawn must be that the productivity points are not a good substitute for land values in comparing the importance of agricultural land for society in the various areas. For a number of counties, (where a large percentage of the land price variation is explained by the point system), however, it is a reasonable substitute.

DETERMINATION OF LAND VALUES

The data provided by the Assessment Branch of the Department of Municipal Affairs do not contain information on additional economic forces important in land value determination. However, these data can be combined with information from the 1966 census. Since land values cannot be fully explained by soil quality alone, this additional information could throw more light on the determination of agricultural land values. Certain forces expected to affect land values per acre were tested by means of a regression analysis.

The smallest data observations in the census are those per township. Thus the Assessment data, land value and productivity points, must also be converted into township data. This is done by adding all farm sales as well as productivity points from the farms sold in the respective township and dividing both by total acreage sold. Thus the

regression analysis is performed with township data, while the previous one, where land values were regressed against productivity points, was performed with individual farm data. Therefore, the two analyses are not completely comparable. In other words, the second equation is not additive to the first one. Only those townships are included from which individual data on land values and productivity points are recorded, recalling that the following counties are excluded: Halton, Peel, York, Ontario, Muskoka, Parry Sound and Haliburton. The analysis includes 224 townships in Southern Ontario.

The analysis was performed by means of a stepwise regression. Seventeen variables expected to exert an influence on land values were tested. A stepwise regression starts with regressing the dependent variable on that independent variable providing the greatest reduction in the unexplained variation of the dependent variable. At each step, a new variable (from the 17 to be tested) is included which is next in line in providing the greatest reduction in the unexplained variation. Beyond a certain step, additional variables may no longer reduce the unexplained variation. They are omitted on the grounds that they do not exert any additional influence on land values.

The 17 variables expected to influence land values are:

1. Value of Machinery and Equipment per Acre of Farmland
2. Value of Livestock and Poultry per Acre of Farmland
3. Wages of Hired Labour and Imputed Cost of Operator Labour per Acre of Farmland
4. Total Days of Off-Farm work per Acre of Farmland
5. Field Crop Sales as Percentage of Total Value Product Sold
6. Potatoes, Roots and Tobacco Sales as Percentage of Total Value Product Sold

7. Horticultural Product Sales as Percentage of Total Value Product Sold
8. Cattle and Calves Sales as Percentage of Total Value Product Sold
9. Dairy Sales as Percentage of Total Value Product Sold
10. Other Livestock and Poultry Product Sales as Percentage of Total Value Product Sold
11. Forest and Other Agricultural Product Sales as Percentage of Total Value Product Sold
12. Distance to Toronto
13. Distance to the Nearest Centre of >100,000 Inhabitants
14. Distance to the Nearest Centre of 50,000 - 100,000 Inhabitants
15. Distance to the Nearest Centre of 20,000 - 50,000 Inhabitants
16. Productivity Points per Acre of Farmland
17. Dummy Variable (0 for Shield Townships and 1 for Remaining Townships)

The observations of the above variables are on a township basis. As will be recalled, in western Ontario the woodlands were not rated for productivity points and the land value excludes wood and bushland. Therefore, the per-acre figures in the list of explanatory variables are for western Ontario, obtained by dividing the particular township variable by the total farm acreage minus woodlands and in eastern Ontario by total farm acreage.

Description of the explanatory variables -- The first three explanatory variables are inputs in the agricultural production process. It is hypothesized that the more intensively the land is used, the higher its value. There appears to be a high intercorrelation between value of machinery and equipment per acre and total wages per acre ($r = .9$) therefore it is unlikely that both variables will appear in the equation; the strongest one gives the combined effect of the two. Actually it is the difference in money yield between farm output and nonland inputs

that affects land values. One cannot assume that an increase in inputs always results in a proportionate increase in net rent per acre. Therefore, gross farm sales should also be included as a separate variable. However, in a separate correlation matrix it appeared that there was a high intercorrelation between total value of products sold per acre and farm machinery and equipment per acre (r = .87) and between total value of products sold per acre and total wages per acre (r = .85). Therefore, either input seems to be a good indicator for economic intensity and profitability.

The fourth explanatory variable, the total number of days of off-farm work per acre, can have different effects. One can hypothesize that this variable is a correction for hired farm worker's and operator's wages and hence decreases the intensity level of farm production. In this instance one expects a negative influence on land values. If off-farm work occurs in seasons when the agricultural process requires hardly any labour (such as the winter season in horticulture) then no influence at all is expected on land values. On the other hand, an equally valid hypothesis is that off-farm work limits the market supply of land. If farms do not provide a sufficient income, farmers could either quit farming and enter a new occupation, while putting their land on the market, or they could supplement their income by working part-time off the farm. In this instance they hold on to their land. A third possibility is farm amalgamation. If there is demand for land for farm amalgamation, but the market supply is limited owing to part-time off farm work, one expects an upward pressure on land values.

The next 7 explanatory variables expressing various categories of agricultural products as a percentage of total products sold give an indication of the type of farming. These could all have a different effect on land values. Some of these types are land intensive, others

are land extensive; for some the pressures for farm amalgamation are greater than for others. One may also expect that an equal change in inputs may affect gross revenues of the various farm types differently. It is difficult to hypothesize beforehand what the effect on land values would be.

Distance from markets is an important force affecting land values. Market prices of agricultural products are usually quoted in a particular consumer or distribution centre. Farmers receive market prices minus transportation costs. Input prices are also affected by distance from markets. Transportation costs play a less important role presently than they used to do; many distortions are found, for example, milk prices received by farmers do not relate adequately to the locational factor. This is because of free market interference by the Milk Marketing Board. The distance factor is separated into four different categories, according to size of the market centre. A negative relationship between distance and land values is expected.

The productivity points expressing soil quality has been discussed in great detail. It is interesting to note that there is not a high correlation between total value product sold per acre and the productivity points per acre. A separate correlation matrix reveals that the simple correlation coefficient is .56. The correlation between farm machinery and equipment per acre and productivity points per acre is .66. This indicates that the differences in intensity levels and profitability among soil types is not as pronounced as one might expect. The effect of soil quality on land value is expected to be positive.

The last explanatory variable is a dummy, separating the Shield townships from the remaining ones. The effect results in a

different constant term for the two areas. This variable is included to allow for possible differences between the two areas.

Time differences in variables -- As was indicated, the dependent variable, land value per acre, is measured as an average over the period 1967-1970, while the explanatory variables, changing over time, are measured in 1966. This time lag is not serious, since a lagged response on land values is expected. Buyers and sellers anticipate an income stream in the future, but the expectation is to a great extent based on past experiences. For those variables where the time lag is less relevant, such as for total days of off farm work, we assume that these variables have not varied greatly in that particular time lapse.

Interpretation of the model -- The independent variables adding to the explanation of land values are listed in the order of appearance in the stepwise regression:

1. Value of farm machinery and equipment per acre
2. Distance to Toronto
3. Field crop sales as a percentage of total value of products sold
4. Productivity points per acre
5. Forest and other agricultural product sales as a percentage of total value of products sold
6. Total days of off-farm work per acre
7. Cattle and calves sales as a percentage of total value of products sold
8. Dummy variable

The regression equation, with these eight explanatory variables included, explains 71 percent of the variation in land values among townships (adjusted multiple correlation coefficient is .842). It is interesting to note that when land values were regressed on productivity points alone per economic region, the highest R^2 was .38 in the Lake

Erie Region. Although the two equations are not completely comparable because one is performed with individual farm observations and the other with township observations, it appears that the above mentioned explanatory variables add significantly to land value determination.

Table 40 provides the relevant information. The variables are listed in the order of descending β-coefficients; these coefficients are obtained by multiplying the regression coefficients by the ratio of the standard deviation of the respective independent variable over the standard deviation of the dependent variable. The original variables are all expressed in different units and thus the magnitude of the coefficients is no measure of the importance of the particular variable. By eliminating the units of measurement, one is better able to compare the relative strength of the individual explanatory variables on the determination of land values. Thus it appears that the value of farm machinery and equipment per acre, which is an indicator of economic intensity and profitability levels, exerts the greatest influence on land values, exceeding soil quality.

All included variables, except the dummy variable, are highly significant. Livestock and poultry per acre, as an input in the agricultural production process, does not appear to exert any influence on land values.

For the variable total days of off-farm work per acre the hypothesis must be accepted that part-time off-farm work limits the market supply of land, since the coefficient has a positive sign. A decreasing supply of land for sale leads to higher market prices. The intercorrelation between this variable and all other independent variables included in the correlation matrix is rather low; the highest are between off-farm work and farm machinery and equipment ($r = .47$) and between off-farm work and total wages ($r = .49$). Among the different farming types, the highest

TABLE 40

The Determinants of Land Value Among Townships;

Estimated Coefficients and Statistics From Regression Analysis

Explanatory Variables	Estimated Coefficient	t - ratio	β-coefficient
Value Farm Machinery and Equipment per Acre	2.620**	8.605	.5826
Productivity Points per Acre	1.437**	4.758	.2648
Field Crops Sales as % of TVP[1]	2.324**	4.527	.1908
Distance to Toronto	- .085**	-3.656	-.1671
Cattle and Calves Sales as % of TVP[1]	.595*	2.012	.1047
Total Days of Off-Farm Work per Acre	49.732*	2.266	.0967
Dummy	-20.159	-1.650	-.0957
Forest and Other Product Sales as % of TVP[1]	2.181*	2.250	.0836
Constant	-63.678		

R^2 (adjusted) = .709   Number of observations = 224

[1]TVP = Total Value Product Sold

*Significant at the .05 level

**Significant at the .01 level, by a two tailed t-test

intercorrelations are between off-farm work and field crop sales (r = .25), between off-farm work and horticultural sales (r = .36) and between off-farm work and cattle and calves sales (r = -.37). The first two probably indicate a rather slight seasonal effect; field crops and horticulture are seasonally bound. The conclusion must be that off-farm work is highly randomly distributed within a particular farming type. Since the different farming types do not possess similar seasonal labour requirements one would expect those types with low requirements in certain periods of the year to correlate highly with off-farm work. This apparently does not occur and therefore it seems that off-farm work is not limited to seasons with low labour requirements. This supports the hypothesis that off-farm work leads to a decreasing market supply of land for sale and hence to increasing land values.

The intercorrelation between off-farm work and the distances to the various centres is low. The highest intercorrelation is that between off-farm work and distance to the nearest centre of 50-100,000 inhabitants (r = -.29). These centres, therefore, seem to have had little effect on part-time work.

Three of the variables indicating types of farming are significantly different from zero, namely, field crop sales, cattle and calves sales, and forest and other product sales. The first two are highly land-intensive and there is probably quite a pressure for farm enlargement and amalgamation in these types of farming. This holds even for the beef feedlot farm, where enough acreage to grow roughage must be available in order to support this operation. Increasing demand for land for farm enlargement leads to upward pressures on land value. Dairy production is limited by a quota system and the pressure for farm enlargement is, therefore, likely less strong. The same holds for

tobacco production. Horticulture and pig and poultry production are, to a much lesser extent, dependent on land and pressures for farm enlargement are likely absent. The significant effect of forest and other agricultural products on land values is probably explained by the fact that in eastern Ontario land values are higher if woodlands are more mature and yield some revenues. The value of the woodland is included in the sale price in eastern Ontario.

The location of the townships relative to Toronto exerts a definite impact on land values and the sign of the estimated coefficient is similar to that hypothesized earlier. The analysis did not show a significant effect of other major centres on land values.

The productivity points indicating soil quality have a definite effect on land values. The sign of the coefficient is in accordance with the expected sign for this variable.

Summary and Conclusion -- Soil quality is not the only factor affecting land values. As the analysis indicates, the economic intensity and profitability level exerts an even greater impact. Furthermore, the location of the township relative to Toronto has a definite effect on land values. These are all important land value determinants and they play an important role in evaluating the importance of agricultural land for the province or nation in a particular area.

For the variables indicating types of farming and off-farm work, the interpretation is somewhat different. These forces point to a position in agriculture that is not well adjusted within the economy, making land values higher than they would be under a situation where readjustment has occurred. The price increase in land owing to these factors does not primarily give an indication of the importance of land for provincial or national income. For land use planning as well as for

taxation purposes, the first factors are important. However, it should be kept in mind that there is still roughly 30 percent of the land price variation that cannot be explained by the independent variables tested.

CHAPTER 6

REGIONS AND PLANNING FOR ONTARIO AGRICULTURE

DEFINITION OF REGIONS

The response of Southern Ontario's agriculture to external and internal pressures for change has been far from spatially uniform. In viewing the series of maps depicting change from 1951 to 1966 strikingly similar broad regional patterns emerge time after time. In any planning for agriculture in Southern Ontario recognition of this regionalism is important. It is unlikely that policies designed for Southern Ontario will have spatially universal applicability or utility. Problems particular to specific regions may require policies inappropriate or of lower priority elsewhere. Conceivably policies appropriate to one area could have a detrimental effect on another. A search for an explanation of regional differences may also raise questions that need to be investigated much more thoroughly before appropriate policies can be initiated.

Any system of regionalization involves a degree of generalization. Regional boundaries are usually zones of transition rather than sharp breaks. Homogeneity within regions is seldom in fact found. Nonetheless, based on differences in space and over time in the several kinds of response discussed in Chapter 4, regions emerge reasonably clearly. As shown in Figure 59, they are: A) the Shield area

B) Eastern Ontario

C) South central and Southwestern Ontario

D) the major urban shadow area forming a broad arc around the western end of L. Ontario (a sub-region within (C) above)

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AGRICULTURAL REGIONS OF SOUTHERN ONTARIO

DIFFERENCES BY REGION

The degree and direction of adjustment in these areas to external and internal pressures for change have in general been strikingly different. The following catalogues the more significant differences and suggests some of the implications these differences may have.

A) The Shield Area -

Characteristics:

- lower proportion of soil types 1, 2 and 3
- larger farms but a small acreage of improved land per farm
- higher proportion of small farms and small-scale commercial farms based on value of sales -- average sales per farm under $2500 for most townships
- higher proportion of farm operators over 54 years of age
- absolute decrease in the value of products sold 1951-1966
- decline to low rate of increase in the $ value of total non-land inputs, 1951-1966
- higher proportion of farmers reporting off-farm work but a low number of days worked off the farm per farm reporting off-farm work
- considerable absolute and high proportional loss of farmland
- insignificant contribution to total output from agriculture in Southern Ontario
- rapid increase in intermittent residential occupancy

With a poor land base for agriculture, declining farm sales and an older farm population the future of agriculture in this region is not bright. Policies to prop up agriculture in this region would probably be a missallocation of resources. Rather, policies should probably be designed to expedite transition from agricultural to nonagricultural use. Critical attention will have to be given to the economic and social welfare of the individuals affected to aid them in the transition. From the point of view of loss of farmland and agricultural production

there is little if any need for concern. On the other hand an orderly transition is desirable. The area constitutes a resource of enormous importance to fulfill the needs of people for recreational open space. As pressure mounts on what are now deemed desirable recreational sites changes in attitudes and expectations are likely to occur. Active provincial participation in the land market may well be justified in this area to aid in the orderly transition and to secure land for future public requirements.

B) Eastern Ontario -

The reasons for the relatively poor performance of agriculture in this region requires further investigation and remedial action. The land base for agriculture is better than the performance of the industry would suggest. Most of the feed and forage crops basic to the integrated livestock industry of the province can be grown as successfully in the region as elsewhere in the province.

In seeking reasons for the poor performance of the industry in this region only a series of observations can be offered at this stage.

a) Apart from Ottawa (whose prosperity in terms of income is not a reflection of the local economy) the general level of economic prosperity in the region is low.

b) The region is isolated from the major provincial agricultural markets and marketing channels and isolated from its natural metropolitan focus, Montreal, by a provincial boundary.

c) The region is relatively isolated from the major areas of innovative activity and decision making in the province.

d) Ottawa, the second major ranking metropolitan focus in Ontario has not grown and developed with the same type of reciprocal relationship between city and countryside as one might normally expect but rather

as a city with a specialized national role.

e) The cumulative effect of isolation and general economic disadvantage is probably reflected by less ready acceptance by farm operators of innovation and risk taking and a more conservative attitude toward change.

f) A concerted effort based on a vigorous extension education service to the farmers would undoubtedly raise the agricultural productivity of this area to a higher level and aid in reaching the production potentials.

C) South Central and Southwestern Ontario -

a) Based on physical characteristics and socio-economic attributes this region, apart from a few isolated subareas such as the escarpment townships and portions of Grey County, appears to be adjusting adequately to the various pressures on the agricultural industry.

b) This region embraces the "heartland" of Ontario agriculture. Farmers are fairly young and willing to accept innovations. The result is an area of fairly high agricultural output and of viable farms.

c) Based on past performance, agriculture in this region, comprised of the range of types from specialty cash crops, dairying, mixed and intensive and extensive livestock operations, should continue in a fairly healthy state.

D) The "Urban Arc" -

This area, consisting of a band of townships roughly some 30 miles in width, stretches approximately from the Port Hope - Cobourg area in a broad arc encircling the western portion of Lake Ontario. Here the agricultural industry is competing directly for land with urban oriented interests.

a) The region is characterized by specialty fruit areas in the Niagara

Peninsula, by amenity type agricultural activities such as greenhouses, nurseries, sod farms and equine farms in the Hamilton - Toronto area and by isolated examples of extensive corporate farm holdings.

b) High land values, reflecting the direct demand of land for urban purposes, have retired a high proportion of farmland from agricultural use. The result is a high level of unimproved land which does not reflect the agricultural potentialities of the area.

c) The farmers themselves have adjusted their operations to take advantage of urban job opportunities with the result that the level of off-farm work commitment by farm operators is one of the highest in Southern Ontario.

d) It is imperative that special attention be directed to those unique tender fruit growing areas of the Niagara Peninsula.

e) The high rates of land loss from agriculture will result in a loss of the amenity value of land to the general public, particularly when the land is occupied by rural low density and urban residents. The weak competitive position of agriculture in this area to urban pressures means that major decisions will have to be made on the use of land in this area. The rapid conversion of land to urban uses is likely to continue at its present rate at least, and it must be questioned if this is socially if not economically justifiable.

SOIL CAPABILITY AND PLANNING

Soil capability has a role to play in the planning of a region or an area. Soil capability provides a type of information for selecting among possible courses of action and it can be used at certain stages of the planning process. Certainly, estimates of the quality of the soil for different uses is of value in conducting an inventory and analyses.

Perhaps the greatest value of the productivity indices derived in Chapter 2 lies in planning land use. Where the supply of a resource is limited and the demand for it is expanding the question of how the resource should be used becomes pressing. It involves economic aspects since a choice must be made from among alternative uses. The institution which commonly determines choice among several alternatives is the market place. Market prices act as indicators both on the consumption side and on the production side. This institution, however, is not the perfect instrument for all situations. It may even be irrelevant for some. Its shortcomings tend to be accentuated as population and other pressures increase. The market allocation process is summarized by van Vuuren[1] as follows:

> Decisions by individual decision makers with respect to land use are guided by prices. For example, if the price of corn is increased relative to that of barley, it is interpreted as a signal that corn production should be expanded at the expense of that of barley. The higher returns on corn production will be translated into higher values for land suited to corn production. These higher land-values would discourage the use of land for crops yielding lower returns, provided the farmers wished to maximize profits.

Not only is land use guided by prices, it should also be guided by yields,

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[1]Willem van Vuuren, "The Challenge of the Land: Economic Aspects," in Environmental Change: Focus on Ontario, ed. D. E. Elrick, (Don Mills: Science Research Associates, 1970), p. 34.

since yield just as much as price is an element of the returns from a particular use. Thus, the yield predictions and capability evaluations reported in previous chapters can be of some help in planning land use.

But what are some particular applications of the data presented in this report to planning? These are numerous and deal with such diverse subjects as taxation and the planning of cropping practices on the individual farm. The yield information can be particularly useful in estimating the amount of land required by agriculture and its location. This question has been asked of the Ministry of Agriculture and Food in Ontario on many occasions[1] but satisfactory answers have not been provided because no estimate of potential yield of common field crops could be given. Nor was it possible to arrive at an estimate of the amount of arable land present. Now both of these estimates have been made and can be used to plan the future of agriculture.

The following applications of yield data to the planning process are given to illustrate the value of the information. Because the yields and their predictability apply only to Southern Ontario the examples chosen are those applicable to this part of the province also.

Before presenting the role of soil capability in planning it should be made abundantly clear the the yields given for each crop are the top yields; the best yields obtainable under today's technology. Yields may increase in the future with improved technology but, assuming high management levels are followed, the spread of yields between the classes can be expected to remain the same. In other words, no matter what technology is used class 2 land will produce only 80 percent of the

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[1]E. L. Ward, Chairman, Land Planning Committee, Personal Communication.

yields of class 1 land, class 3 land will produce only 64 percent of the yields of class 1 land, etc. We should be reminded that the soil capability classification is not based on present use or even the present state of the soils in some instances. Soils considered feasible for improvement by draining, by irrigating, by removing stones, by altering soil structure, or by protecting from overflow are classified according to limitations or hazards in use that remain after the improvements have been made.

Land Allocation for Agriculture

Various policies have been established to improve the agricultural industry in this province but few of these are directly concerned with the land. The most recent of the land policies is the A.R.D.A. farm enlargement and consolidation programme. This programme was inaugurated in 1966 to help farmers enlarge their holdings into an improved economic farm unit and provide a better opportunity for farmers no longer wishing to farm, to sell out. One of the guidelines of this programme is that farms to be acquired for the enlargement of an existing farm unit should generally not contain less than 50 acres of arable land and should be adjacent to the farm to be enlarged. This minimum condition of 50 acres is seen as being particularly significant. Arable land is defined as comprising classes 1, 2 and 3 soils. Because less class 1 land is required to obtain a certain yield than class 2 or 3 land, the decision with respect to a potential acquisition becomes easier because the differences in productivity among classes can now be taken into account by farm appraisers and extension personnel involved in the farm enlargement programme.

Many Southern Ontario communities are faced with the problem of reconciling competing claims for the use of certain parts of their land surface. It is rare for any particular use to be completely rejected if it is accepted that uses of land are socially rather than physically determined. The best use of any piece of land is a relative rather than an absolute problem and we should accept that best use can and will change from one generation to another depending on the range and priority of uses that society wants satisfied from its physical environment.

In deciding to make a major change in the use of a particular piece of land there is a school of thought which believes that the existing use and users of the land have the first claim and the proposed new use and new users should prove that the community will benefit if the land in question is passed over to them[1]. It is significant that in Great Britain and some other European countries agricultural land has the prior claim in the conflict of land uses. Such is not the case in Canada. There is no comprehensive Planning Act dealing with the problem of compensation and betterment and the protection of agriculture. Planning is done by local option under permissive legislation. Because planning in the context there deals with land resources which are under provincial jurisdiction by the British North America Act, the Federal government is unable to pass a national act and Canada thus has 10 separate systems. Agriculture as shown in Ontario plans or zoning by-laws often simply means land not yet urbanized. Even forestry competes and makes inroads into "agricultural" land.

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[1]G. P. Wibberly, Agriculture and Urban Growth, A Study of the Competition for Rural Land, (London: Michael Joseph Ltd., 1959), p. 73.

Thus the evidence for Canada indicates that the onus of proof as to the benefits from a land use change does not rest with the new users or the new use. Perhaps we would be more successful in our attempts to reserve high quality land for agriculture if it was incumbent upon the new use to show cause why land should be diverted out of agriculture. Resolving this conflict depends upon the assessment of the country's economic position in relation to its total food supplies and involves decisions as to the proportion and type of food better obtained from home-land resources. These decisions can be more readily made from soil capability information such as that provided in this study.

Taxation

Traditionally taxes produce revenues for public expenditures. However, over the years taxes have been increasingly used as control measures, either to encourage or to discourage particular economic activities. Land taxes seldom reflect the current productivities of land resources. The most equitable taxes are those based on ability to pay. In Ontario agricultural land is assessed at market value[1] which is influenced by many factors other than productivity. Some attempt, however, has been made to introduce productivity into the evaluation of farm land for taxation purposes but not in Ontario or many of the other provinces. Early attempts to introduce soil productivity into the valuation of land for tax assessment were made by Ottoson, Aandahl and Kristjansen in the State of Nebraska[2]. They computed economic ratings

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[1]Government of Ontario, Report of the Committee on Farm Assessment and Taxation, Toronto, 1969, p. 33.

[2]Howard W. Ottoson, Andrew R. Aandahl and L. Burbank Kristjansen, Valuation of Farm Land for Tax Assessment, Bulletin 427, Experiment Station, University of Nebraska, 1954, pp. 17-25.

for soil from yields and production costs based on the typical management system. This system was not completely acceptable in many states and provinces because of the lack of reliable yield data and because of the variability of yield within soil types. The yield data collected by class overcome both of these objections in that they supply information never before provided and group soil types into classes within which yield variability is reduced.

The performance indices calculated for each soil class could be used to estimate a value of land for farming. Noble[1] developed performance indices for soil classes based on labour income from dairy farms; the Committee on Farm Assessment and Taxation[2] estimated values for soil classes based on the market value of farm properties; and Anderson[3] produced indices for soil classes from forage yields. The indices developed from all these sources are given in Table 41.

It appears from Table 41 that the reduction in value of soil class from 1 to 6 developed by Noble and the Committee on Farm Assessment and Taxation does not conform to the reduction in forage and arable crop values obtained for Anderson's work and this study. The major discrepancy involves the marginal land classes (classes 4, 5 and 6) in that the values given by measuring crop productivity are two to four times those produced from Noble's work and that of the Committee. These

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[1]H. F. Noble, Socio-Economic Problems and Adjustment Needs of the Farm Family in Eastern Ontario, Dept. of Agriculture & Food, Toronto, 1967, p. 26.

[2]Government of Ontario, Report of the Committee of Farm Assessment and Taxation, Toronto, 1969, p. 37.

[3]J. S. Anderson, "The Relationship Between Soil Class and Forage," (M.Sc. Thesis, University of Guelph, 1971), p. 43.

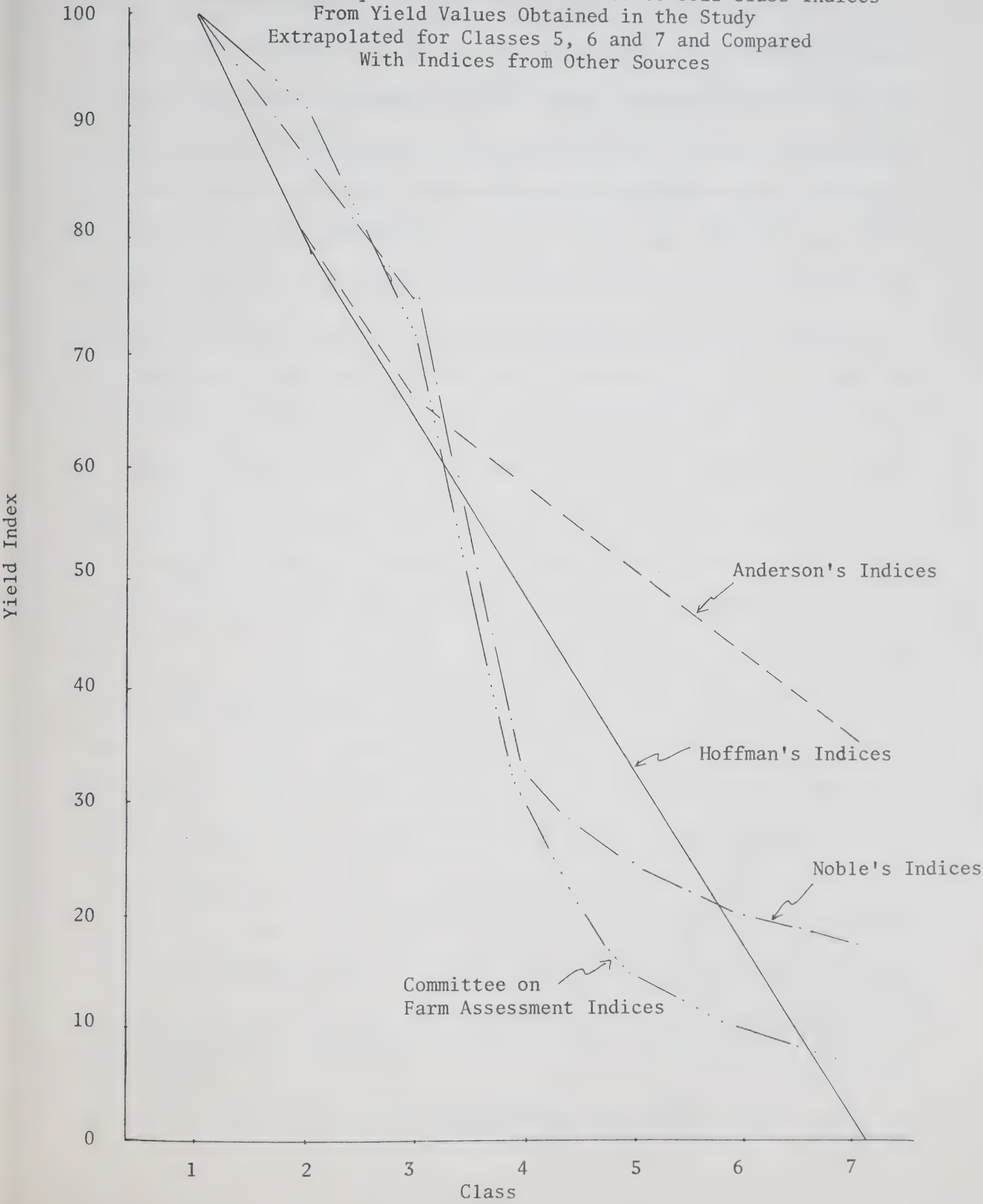
TABLE 41

Comparison of Performance Indices for Soil Classes Developed from Market Value Figures Prepared by the Committee on Farm Assessment and Taxation; from Noble's Concept of Adjusted Acres; from Anderson's Forage Yield Values; and from Yield Values Obtained in this Study.

Class	Arable Crop Yields	Anderson's Forage Yields	Noble's Adjusted Acres	Market Value (farming)
1	1.00	1.00	1.00	1.00
2	.80	.80	.87	.92
3	.64	.66	.75	.72
4	.49	.58	.33	.30
5	no value	.53	.25	.15
6	no value	.44	.20	.10
7	no value	no value	no value	.07

FIGURE 60.

The Relationship of Performance Indices to Soil Class Indices
From Yield Values Obtained in the Study
Extrapolated for Classes 5, 6 and 7 and Compared
With Indices from Other Sources



differences create some problem in deciding which group of performance indices should be used when evaluating land for taxation purposes. The number of external factors influencing market value would seem to rule out the use of the indices prepared by the Committee on Farm Assessment and Taxation. Noble's indices are derived from estimates of labour income in dairying and therefore both expenses and productivity are taken into consideration but the values given for classes 4, 5 and 6 were not based on statistical evidence but rather on an opinion[1]. It is not suggested that these performance indices are of no value in estimating land value. Both the Committee's and Noble's indices were developed to show economic benefits accruing to the land resource and were not directly related to the soil's ability to produce crops. It is suggested that the performance indices prepared in this study and in Anderson's are far superior in producing information on differences in physical capability for crop production because measurements made were directly related to crop production.

There is, however, a major disadvantage in using the class indices produced from the crop yields in this study. No values are shown for classes 5, 6 and 7 and this is a serious limitation if all classes of land are to be evaluated for property tax purposes. This problem can be overcome by extrapolating the data as shown in the graph in Figure 60. Extrapolation indicates yield indices for common field crops of .33 for class 5, .17 for class 6 and .02 for class 7. These appear to be reasonable for crops such as corn, barley and oats especially since the

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[1]H. F. Noble, An Economic Classification of Farms, (Toronto: Department of Agriculture and Food, 1965), p. 9.

definitions[1] state that classes 5, 6 and 7 comprise a grouping of non-arable soils and, in addition, class 7 is non-agricultural. The low indices, especially that for class 7 of approximately 2 percent of the yields obtained on class 1 soils, seem to agree with the class definitions. Anderson's indices for classes 5, 6 and 7 are considerably higher probably because the soil requirement for forage crops are lower than for corn, barley and oats.

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[1]Department of Regional Economic Expansion, Soil Capability Classification for Agriculture, Report No. 2, A.R.D.A. Branch, Ottawa, 1969, p. 3.

SOIL CAPABILITY AND THE DECISION-MAKING PROCESS

As has been mentioned, one of the possible uses of yield data by planners is to estimate potential agricultural production and to suggest which land should be set aside for agricultural use. With the completion of the soil capability maps and the development of prediction equations in this study it should now be possible to predict with greater certainty agricultural production in the regions of Southern Ontario. (Further study is required before these equations can be applied to all of Canada).

With the 20 percent decrease in productivity between class 1 and 2 land there is some doubt whether farmers can use class 2 to produce the common field crops and still realize a profit. There is little doubt at all that class 4 land cannot be the basis for profitable agriculture when only common field crops are grown. A 50 percent difference between production on class 1 soils and that on class 4 is too great to warrant using class 4 soils for most cultivated crops. Performance indices do help with the decision-making process but they do not provide the whole answer to the solution of land allocation problems. Much additional economic data is required before adequate answers can be provided.

Some of the major problems concerning land utilization at present are (1) the manner in which land use changes as a response to changing forces in society, (2) the question of whether or not (and how) land should be safeguarded for future agricultural needs, and (3) the identification and quantification, where possible, of social benefits and costs associated with land use and especially with land-use change. It is not within the terms of reference of this study to discuss the

ramifications of all the forces influencing land use and land use change although it should be mentioned in passing that agricultural land use is not without its spillover effects.

What should be done and what is the future for agriculture? Current trends indicate that the numbers of farms in North America will continue to decrease over the next few decades. Farms will be larger and they will employ fewer persons but provide higher per capita earnings.

Urban uses compete for farmland but many of those farms considered to be technologically backward or of only moderate economic viability will also be lost as production units. Urban penetration threatens a significant portion of the finest farmland around many cities. After all, land that is of high quality for farming is also of high quality for other uses. In Southern Ontario urban competition for farmland is becoming a problem around many of the cities. Urbanization often brings a wasteful mixture of urban, farm and vacant land use which is costly to service. It leads to conflicts between farm activities which cause dust, odours and noise and the kind of environment sought in adjacent new residential areas.

Several factors create this scattered land use pattern. A farmer offered a good price for his land for urban uses has little incentive to consider the adverse effects on his farmer neighbours -- rising taxes for suburban services, regulations limiting farm operations and loss of a chance to increase the size of their farms to gain economies of scale. Any farmer in an urbanizing area is tempted to delay new farm investments, either in the hope of selling profitably or in the fear that rising taxes or other pressures will force him out before the investment pays off. As this delay makes his farm less competitive, he may have to give up farming anyway, thus leaving vacant land unused

for agriculture and not yet wanted for urban use. Aside from their economic values some farms should remain for open space or other ecological reasons. Which specific lands are more valuable for open space than for urban development requires study and the use of production data, among other things.

It is not necessarily bad to have less farmland, but the pattern of retrenchment is an important public concern. One possibility is to encourage improved agricultural practices on low viability lands. But according to this study, no amount of improvement in agricultural practices will increase productivity of a low class land receiving the same level of inputs. In other words, because the predicted yields represent the top yields obtainable under today's technology any future technological change is likely to affect all seven classes in the same way. For example, if the same level of inputs is applied to class 1 soils as is applied to class 4 soils the class 4 soils will still produce 49 percent of class 1 production regardless of technological change. It is true that new technology may allow us to use non-arable (classes 5 and 6) land for arable agriculture and thereby improve its productivity but as has been stated before, application of the same input levels to other classes of land will increase their productivity too. But, yield differences between classes will remain in the same proportion outlined by the productivity indices presented in Table 11 .

This concept can only hold when soil conservation is practised; when the farmer follows the best management practices available. Obtaining the potential yield of common field crops on a particular class of land does not ensure the greatest profit. Indeed the capability classification for agriculture is not a guide to the most profitable use of the

land.[1] The concept that the performance indices will remain the same no matter what the level of technology could cause some changes in public policy with respect to farming especially those concerned with farm enlargement.

A.R.D.A. has developed a programme which is designed to overcome the problems of small farm size. Farmers with farms they no longer wish to operate are encouraged to sell to A.R.D.A. who may, in turn, lease or sell them to neighbouring farmers. In theory this policy provides the remaining farmers with larger, more economically viable units. But this is not always the case. Under certain conditions the acquisition of more land can be a hindrance. Clearly the provision of many additional acres of non-arable land to a farmer intent upon increasing his arable crop acreage is doing him no favour at all. He cannot expect the kind of productivity on classes 4, 5 and 6 land which will meet the costs of production. Abraham and Fisher briefly report production costs and returns for grain corn grown in Southwestern Ontario.[2] Using a yield of 76 bushels per acre and a selling price of $1.25 a bushel they show gross returns of $95.00 per acre. Average measurable costs are calculated to be $73.00 per acre. Net returns are therefore $22.00 per acre. According to figures presented previously an average yield of 60 bushels per acre can be expected on class 4 soils provided top levels of management are applied. Using the same selling price for grain corn and the same costs per acre as before, net returns per acre of class 4 land can be calculated to be

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[1] Department of Regional Economic Expansion, Soil Capability Classification for Agriculture, p. 5.

[2] F.R. Abraham and G.A. Fisher, Soybean Production, Production Costs, Returns and Management Practices in Southwestern Ontario 1957-59-65, (Toronto: Ontario Dept. of Agriculture and Food, 1967), p. 25.

$2.00 per acre. But it is most unlikely that the costs of production will remain the same. In all likelihood they will be greater on the class 4 soils than on the soils of higher quality used by co-operators in Abraham and Fisher's study and a loss will occur.

These results are supported by a report of the Special Committee on Farm Income in Ontario.[1] With a yield of 94.5 bushels of grain corn per acre, a crop value of $1.22 per bushel and costs of $90.00 per acre the report shows returns ot $25.00 per acre. With an average yield of 60 bushels per acre on class 4 land a loss of $16.80 is incurred whereas a profit of $7.60 per acre could be realized on class 3 land. Similar calculations can be made for barley using the figures given in the report of the Special Committee[2] and the yield predictions developed in this study.

It is feasible, then, that economies cannot always be effected on the farm by simply providing a larger acreage, unless the additional acres are high quality soils. Undoubtedly the current A.R.D.A. programme of land consolidation and farm enlargement will achieve success only in areas where, among other things, there are large amounts of class 1 and 2 land. The returns from class 3 soils appear so small that a decrease in market price or an increase in production costs could result in a loss.

Scott[3] has said, "Resources do not just disappear, but as the

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[1] Special Committee on Farm Income in Ontario, The Corn Industry in Ontario, (Toronto: Ontario Dept. of Agriculture & Food, 1969), p. 62.

[2] Ibid, p. 62.

[3] Anthony Scott, Natural Resources, p. 13.

highest grade stocks are consumed lower grades take their place requiring higher costs of exploitation." This might be related to agriculture. As class 1 and 2 soils are consumed for other uses lower grades could take their place to be used for agriculture. However, this can only occur if market prices for farm products increase considerably. It could also be said that lower classes of land cannot fully substitute for higher classes. Noble has said that 117 acres of class 1 soil is equivalent to 135 acres of class 2 soil or 160 acres of class 3.[1] Extrapolating further, 117 acres of class 1 soil is equivalent to about 355 acres of class 4 soil and so forth. Such a relationship does not hold for farms producing general field crops. Although 355 acres of class 4 soil might produce as much grain corn, for example, as 117 acres of class 1 soil the farmer is unlikely to realize a profit. And so, once more it should be repeated that low quality land is no substitute for high quality land in producing common field crops.

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[1] H.F. Noble, An Economic Classification of Farms in Eastern Ontario, (Toronto: Ontario Dept. of Agriculture & Food), p. 9.

CHAPTER 7

FUTURE FOOD DEMAND AND PRODUCTION

THE DEMAND FOR FOOD IN ONTARIO

The demand for food is a function of population, income per capita in real terms and the elasticity of demand for food with respect to that income. It is therefore necessary to use estimates for each of these three factors.

Population

Population projections for Ontario have been made by the Economic Analysis Branch of the Ontario Department of Treasury and Economics, on various assumptions about future fertility rates and migration. Assuming a continuous decline in fertility (A), a greater decline from 1966 to 1971, the lower rate remaining unchanged thereafter (B) and an unchanged rate (C) this study obtained three groups of projections, each of which was combined with a 30,000, a 50,000 and a 70,000 annual level of net migration into Ontario. Using one mortality pattern of a continuous decline, nine sets of projections resulted. They are summarized in Table 42 together with the actual census figures for 1971, and the rates of increase per annum are calculated.

Comparing these projections which were made in 1969 with the actual census figure for 1971, it can be seen that only the high migration assumptions came near projecting the actual outcome, except for the high fertility with the medium migration assumption. If this is combined with an examination of the population trends for Canada and Ontario as set out in Table 43, it can be seen that while the rate of increase declined between 1951 and 1971 both for Canada as a whole and for Ontario, the decline in Ontario was much smaller in the last five-year period, 1966-1971.

TABLE 42

Ontario Population: Actual, Projected and Percent Increase per Annum, 1966-71 and 1971-91

Assumptions	Census			Projected		Projected % increase per annum	
	1966	1971	% incr. p. a.	1971	1991	66-71	71-91
A 30	6,960,870	7,703,106	2.1	7,504,017	9,261,871	1.5	1.0
A 50	6,960,870	7,703,106	2.1	7,610,532	8,868,316	1.8	1.3
A 70	6,960,870	7,703,106	2.1	7.717,053	10,474,764	2.1	1.5
B 30	6,960,870	7,703,106	2.1	7,476,415	9,685,928	1.4	1.3
B 50	6,960,870	7,703,106	2.1	7,582,486	10,320,616	1.7	1.6
B 70	6,960,870	7,703,106	2.1	7,688,562	10,955,307	2.0	1.8
C 30	6,960,870	7,703,106	2.1	7,555,502	10,729,052	1.6	1.7
C 50	6,960,870	7,703,106	2.1	7,662,666	11,412,348	2.0	2.0
C 70	6,960,870	7,703,106	2.1	7,769,831	12,095,648	2.2	2.2

TABLE 43

Census Population and Rates of Increase, Canada and Ontario, 1951-71

	Canada Population	% Increase Per Annum in the last: 5 yrs.	15 yrs.	20 yrs.	Ontario Population	% Increase Per Annum in the last: 5 yrs.	15 yrs.	20 yrs.
1951	14,009,429				4,597,542			
1956	16,080,791	2.6			5,404,933	3.2		
1961	18,238,247	2.5			6,236,092	2.9		
1966	20,014,880	1.9	2.4		6,960,870	2.2	2.8	
1971	21,568,311	1.5		2.2	7,703,106	2.1		2.6

If it is remembered that the migration assumptions are of a given annual level of net immigration, which implies a falling percentage rate, it seems reasonable to assume an annual percentage rate of increase for Ontario of 2 percent, which would result in a 1991 population of 11,446,816.

Per Capita Income

Expenditure on food is likely to be more closely related to per capita disposable income in real terms than to total income. Tables 45 and 46 will be combined with Table 43 to calculate past trends in real personal disposable income in Canada. They will also be used for the next section on elasticity of demand for food.

In Table 45, Disposable Income is deflated by the population growth factor and by the Consumer Price Index (all Items) to obtain the annual growth rate of Per Capita Real Disposable Income of 2.4 percent. These figures are of course for Canada as a whole between 1951 and 1966. For projecting food demand for Ontario in 1991, two annual rates of growth of 2 percent and 3 percent will be used.

Income Elasticity of Demand for Food

The ratios of Table 45 were used to calculate[1] an Expenditure Elasticity and a Volume Elasticity for Canada between 1951 and 1966. These were 0.415 and 0.484 respectively and indicate the average ratios of the proportional change in Expenditure or in Volume to the proportional change in per capita personal disposable real income. These elasticities

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[1]By ratios of log. differences.

TABLE 44

Price Indices, Personal Disposable Income and Food Expenditure, Canada

	Consumer Price Index (1961 = 100)		Personal Disposable Income	Spent on Food	% P.D.I. Spent on Food
	All Items	Food	$m.	$m.	
1951	88.0	94.4	14,794	3,619	24.46
1961	100.0	100.0	26,011	5,820	22.38
1966	111.4	116.6	38,579	7,620	19.75
1971	133.4	131.4	58,857		

Sources: DBS 62-002, Prices and Price Indices, 13-001, 201 and 502, National Income and Expenditure Accounts

Table 45 uses this information to calculate the following ratios:

TABLE 45

Ratios and Annual Rates of Increase, 1951-66 and Income Elasticities of Demand for Food, Canada

	Ratio 1966/1951	% Increase p.a.
Population	1.429	2.4
Personal Disposable Income	2.608	6.6
Spent on Food	2.106	5.1
Per Capita P.D.I.	1.825	4.1
Per Capita Spent on Food	1.474	2.6
C.P.I. All Items	1.266	1.6
C.P.I. Food	1.235	2.2
Per Capita (Real) P.D.I.[a]	1.442	2.4
Per Capita (Real) Spent on Food[a]	1.164	1.0
Per Capita (Real) Volume of Food Bought[b]	1.194	1.2

Real Personal Disposable Income Elasticity of Expenditure on Food = 0.415

Real Personal Disposable Income Elasticity of Volume of Food Bought = 0.484

[a]deflated by C.P.I. (all items)
[b]deflated by C.P.I. (food)

may be compared with other estimates. L. Auer[1] estimated a Family Expenditure Income Elasticity of Demand for food in Canada of 0.202, for 1948-62, using cross section analysis, and of 0.406, for 1949-65, using time series analysis. The time series estimates in this and other studies are often greater because they cover periods during which rising incomes were accompanied by increasing use of processing, freezing and other services which increase expenditure more than quantity of food. Similar estimates of income elasticities of demand for food have been made for other countries and are given below for comparison:

Britain[2]: Expenditure Elasticity, 0.20; Farm Gate Elasticity, 0.165.

Europe[3]

Sweden: Quantity Elasticity 0.2 - 0.4 for major foods

Denmark: Expenditure Elasticity (time series) 0.33 - 0.37,
(cross section) 0.22

France: Expenditure Elasticity 0.37 "mostly in quality"

West Germany: Quantity Elasticity (1962) 0.26, (1965) 0.254,
(1975) 0.238.

A consideration of the above indicates that for Ontario between 1971 and 1991, 0.4 is probably too high as an estimate of income elasticity of demand for food, since there is evidence that the elasticity declines with rising income and it is very likely to have been overestimated because of the strong trend to increased processing and services raising the retail

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[1]L. Auer, Staff Economist, Economic Council of Canada, in "Urban Consumer Incomes and Food Expenditures" a paper presented to the Canadian Economics Association Annual Meeting at Manitoba in June, 1970.

[2]A. M. Edwards and G. P. Wibberley "An Agricultural Land Budget for Britain 1965-2000", Wye College, Kent.

[3]A. M. M. McFarquhar, Ed., "Europe's Future Food and Agriculture" North-Holland Pub. Co.

TABLE 46

Projections of Food Demand in Ontario in 1991

Annual Increase PDI/cap.	2%		3%	
	Ratio 1991/1971		Ratio 1991/1971	
Per Capita Real Personal Disposable Income	1.486		1.803	
	1991/1971		1991/1971	
Food Expenditure	Per Capita[a]	Total Increase[b] %	Per Capita[a]	Total Increase[b] %
with elasticity 0.2	1.082	60.8	1.126	67.3
with elasticity 0.3	1.127	67.5	1.193	77.3
with elasticity 0.4	1.171	74.0	1.266	88.1

[a]Ratio of PCRDI raised to the power of elasticity

[b]The percentage increase which results from multiplying the Per Capita ratio by 1.486, which is the growth rate for a 2 percent per annum population growth over 20 years.

prices of food. On the other hand, Auer's cross section elasticity of 0.202 is low in comparison with some other studies. The projections for 1991 will therefore be made with three assumptions for Elasticity of Demand, namely 0.2, 0.3 and 0.4, with a greater likelihood of the middle one being appropriate. These are presented in Table 46.

ESTIMATING ONTARIO FARM PRODUCTION IN 1991

In order to provide the increased amounts of food demanded in 1991 by a larger and richer population, the output of food must rise in Ontario, or there must be larger purchases of food from other sources, or our sales to other markets must be reduced. This section indicates the different conditions that might prevail in Ontario's agricultural trade and the consequent rates of increase in production.

Ontario agricultural producers sell their output either to Ontario consumption or to markets elsewhere. Our interest here is in final consumption markets rather than the several marketing and processing stages, and hence this analysis is defined in terms of the location of final demand. Consumers within Ontario purchase their food from Ontario sources of production or from sources elsewhere. By definition the consumption purchases from Ontario equals the producers' sales to the Ontario market. For convenience the following notation is adopted:

X = Ontario production

SO = sales to Ontario

SE = sales elsewhere

Y = Ontario consumption

PO = purchases from Ontario = SO

PE = purchases from elsewhere

It is important to distinguish among several kinds of measurement: (a) the level of any one of these variables, (b) the amount by which it changes over time, (c) the (percentage) rate of change, and (d) the share of one variable in some larger quantity.

The analysis which follows proceeds through several steps towards the final objective of calculations of the probably rates of change in Ontario farm output. The first step is to identify the possible kinds of relationship among production, consumption and trade in farm products. The second step is to indicate the conditions which we can most plausibly select as assumptions concerning the future relationships. Two sets of assumptions are selected in order to indicate the probably minimum and maximum rate of change. Having defined the foreseeable trade relations which might exist, these are further refined in numerical terms, and then combined with (a) data on current output, and (b) the projections for demand, to produce a number of projections for the rates of change in production.

There are four different kinds of relationships which might be hypothesized for the changing distribution of Ontario sales between the local market and markets elsewhere between 1971 and 1991.

1. Sales elsewhere (SE) fall (a) to zero, or (b) to some level below the 1971 level.
2. SE stays the same at the 1971 level, which implies that Ontario would be losing in its share of the growing markets elsewhere.
3. SE rises at a rate equal to the rise in consumption in markets elsewhere.
4. SE rises at a rate faster than the growth of markets elsewhere, i.e., Ontario captures a larger share of other markets.

These four possibilities are arranged in order of the relative impact on the rate of increase in Ontario output, from slowest to fastest. The two extreme assumptions are hardly plausible. On one hand, Ontario will resist the loss of any substantial markets. On the other hand, our costs and productivities are likely to increase at least as fast as most other major production areas and we cannot expect major gains in our share of other markets.

The relation between Ontario purchases from Ontario output and from producers elsewhere can similarly be hypothesized to change in a number of different ways.

1. Ontario purchases from Ontario (PO) might (a) fall below the 1971 level, (b) stay constant at the 1971 level, or (c) rise but at a rate slower than Ontario consumption Y.
2. PO rises at the same rate as Y and hence PE also rises at the same rate as Y, both maintaining a constant share of the market in Ontario.
3. PO rises at a faster rate than Y, which implies that PE is a falling share of our market, and for simplicity PE might be assumed to stay constant at the 1971 level.
4. PE is reduced below the 1971 level.

These possibilities are listed in order of their relative implications for the rate of growth of production. The first and the last are quite unlikely to occur. The Ontario agricultural policy could be expected to resist any loss in our share of our own local market as a whole. Ontario producers have a transport cost advantage and marketing system advantages which can be expected to be maintained. On the other

hand, the fourth possible assumption is not very plausible because the Ontario government is not likely to attempt to or be successful in pushing other sources of supply out of our market. Changes in our costs can be expected to parallel those in other regions, and supplying regions will resist actual losses in sales which arise from artificial barriers to trade.

Ontario production will increase and the rate of growth will be within some range which can be considered to be "probably". The more likely lower bound to that range of growth rates would appear to be set by an assumption that (a) our sales to other markets will stay constant at the 1971 level and (b) our producers maintain their current share in our market. These are the second possibilities in each of the preceding lists. Similarly, although one can conjecture about more extreme changes, it is most probable that the upper bound to the rate of growth of production will be determined by the third possibility in each of the preceding lists, i.e., by an assumption that (a) our sales elsewhere rise, at a rate of change equal to the increase in our own consumption, and (b) our purchases from elsewhere stay constant at the 1971 level. This last assumption means that Ontario's output would satisfy all of the increase in the Ontario market.

There is very limited information about trade among the provinces, and there are no comprehensive measurements of the amounts of food bought by or sold by Ontario from other provinces or countries. Such measurements are complicated by the varying degrees of processing which may be included in materials, and by the phenomena of trans-shipments and cross-hauling of the same commodity in both directions. For our purposes the analysis below is conducted in terms of food measured in values at the farm level, rather than in retail or wholesale value. Attention is

focussed on production and sales of food rather than raw materials or intermediate products such as feed or feeders.

In the absence of direct measurements of the trade in farm products into and out of Ontario, some indirect estimates have been made. It is estimated that the 1971 consumer's expenditure in Ontario on food was \$3.78 billion[1]. Assuming an average marketing margin of 60%, the farm value of that consumption is \$1.51 billion[2]. The 1971 value of farm output was approximately \$1.36 billion.

$$PO + PE = 1.51$$

$$SO + SE = 1.36$$

$$PO = SO$$

Therefore, $PE - SE = .15$

The net balance of trade into Ontario appears to be a net import of about \$150 million. Sales elsewhere are a relatively small part of Ontario market demand, and hence our purchases from elsewhere must be a relatively small proportion to purchases from Ontario. Some estimate of these trade relations is necessary for the computations that follow. These arbitrary assumptions are made in order to approximate the range within which the actual values might be, and to test the sensitivity of the overall projections to these alternative assumptions. One assumption about the volume of trade in 1971 might be that purchases

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[1]By assuming for Ontario the 1971 Canadian average Personal Disposable Income (\$2728), and estimating that in 1971 18% of PDI was spent on food, i.e., \$491 per annum per person in the 1971 Ontario population of 7.7 million.

[2]Sixty percent of the 1966 Ontario consumer's food dollar was estimated as being distributed to the processing, wholesaling and retailing sectors by the Special Committee on Farm Income in its report <u>The Challenge of Abundance</u> (p. 31).

from elsewhere provide as much as one-quarter of the entire 1971 consumption, i.e., \$380 million; this would imply that SE is \$230, which appears to be a relatively large fraction of Ontario output (17%). This relationship is called the "high trade" case A in Table 46. Alternatively a "low trade" situation in 1971 has been assumed in case B, with a lower figure for SE set at \$50 million, which would imply PE of \$200 million, which is 13% of consumption. Those seem to be plausible ranges for these figures.

The preceding assumptions concerning trade are combined with the projections of consumption to produce Table 46. Of the several projections of consumption, three rates of change are selected for computation with the several trade assumptions: the highest rate increase of consumption (88%), a medium rate (70%) and the lowest rate (60%). Of these the most probable is the medium rate, but for our purposes it is important to test the upper and lower bounds.

The lower-bound trade assumptions are that SE will stay constant at the 1971 level. The 1971 levels of trade in SE and PE are alternatively assumed at the high and low levels described in the paragraph above. This lower-bound set of assumptions stipulate that both PE and PO maintain their 1971 share of the Ontario market. Assuming 1971 value of production of \$1.36 billion, the rates of increase in the left hand side of the table are generated with a range from 50 percent increase to 85 percent increase over the 20 year period.

The upper-bound trade assumptions are that SE will rise at the same rate as the Ontario consumption market, and that PE will be maintained at the 1971 level. This means that Ontario production would be forced to

TABLE 47

Projected Percentage Changes in Ontario Production to 1991

Consumption Growth Rate	Trade Assumptions			
	Lower Bound		Upper Bound	
	SE constant level PO constant share in Y		SE rises PE constant	
	(A) high trade	(B) low trade	(A) high trade	(B) low trade
60%	50	58	77	69
70%	58	68	90	80
88%	73	85	113	101

Assuming Y = \$3.78 billion retail value 1971

= \$1.51 billion farm value 1971

X = \$\$1.36 billion 1971

Note:- For further explanation of calculations given in this table, see the appendix to this chapter.

satisfy the entire increase in the quantities demanded in Ontario, and at the same time also make larger sales in other markets. The same alternative assumptions about the 1971 trade levels of PE and SE are made, with (A) PE at 380 and SE at 230, and (B) PE at 200 and SE at 50. The computations yield the figures in the right half of the table, with production increases ranging from 69% to 113%. As already emphasized these are based on assumptions deliberately designed to give a maximum upper bound to the production growth while still being within the realm of plausibility.

This table demonstrates the difficulties of projecting the demand for Ontario farm output. The range of growth rates is from 50% to 113% growth, which presents very little guidance. Even that upper figure is doubtless within the capability of Ontario agriculture, providing that such a target is deliberately pursued on a long-range basis and with carefully refined objectives and policy instruments. The upper limit would appear to be quite unlikely. The most probable range is the middle line, which is much less extreme, with a minimum of about 60% rise, up to a 90% maximum. These estimates could be narrowed to much more precise judgements if more informed estimates were made of the actual trade flows.

It is important to note that the production adjustments which would be required in Ontario agriculture to meet the growing market are very much a function of trade among the provinces. Fairly modest differences in trade can have marked effects on the growth rate in Ontario.

All of the preceding has been expressed in terms of the final demand for food alone, and has overlooked the fact that agriculture in one region may buy farm products from another region as inputs for their food products. Livestock feed and immature livestock for feeding are prime

examples. The preceding projections for food in Ontario include a vast amount of livestock products. If we assume that the relation between Ontario grain output and Ontario livestock products can be altered in the future, it becomes clear that there is virtually no relevant limit to the amount of livestock that could be housed inside Ontario. Major realignments in farming would have to take place but could be accommodated. However, there would be some point reached at which intensive livestock housing units would begin to create problems, both inside and outside farming. If no feed grain was produced in Ontario and livestock output rose many-fold, there would develop very substantial problems with smell and animal waste disposal, because of the lack of fields and space to accommodate these wastes. It would become a matter of urgent public land policy to arrange this kind of agriculture among other land uses in acceptable patterns, and eventually it might become an insoluble problem.

No attempt has been made to express these demand projections and production projections in terms of projected acreages of farmland. The uncertainties are already formidable. There would be immense uncertainties, with existing knowledge, in any acreage projections. There are vital gaps in information. There is no comprehensive measurement of the agricultural capabilities of the land actually being used for farming. There are no data on the capabilities of the land being converted to other uses. There has been no projection of the relative rates of change of production, costs and yields in different areas. It has not been possible to estimate the future parameters of demand for land by rural non-farm activities, nor of the supply of land which will be made available and the consequent prices of land.

The general economic relationships of the past indicate that the projected growth rates could be attained without major dislocations. The projected growth of 60 percent to 90 percent in the next twenty years can be compared to the 64 percent growth in physical volume of production in the past twenty years, when supply tended to outrun demand. However, it is essential to temper such a simple premise with some observations about how the future will be different from the past. There has been a very recent acceleration in the conversion of farmland to other uses, arising from a marked shift in the demand for rural land. Environmental changes have become of much greater concern and weight in decisions and public policies. The environmental interactions between agriculture and other activities may accelerate as the intensity of farming is increased and as farming technology puts greater pressure on the productive biological systems. The Ontario agricultural land resource and the industry are not the same now as they were in 1951 when we started the past two decades. The next two decades may reveal markedly different responses and relations.

Nevertheless, it is also necessary to recognize the great adaptability of the relevant systems and that changes will take place in order to adjust to new circumstances. One major change which may be necessary and desirable may be to alter the structure of the rural land market so as to recognize and modify the relative weights of farm demand for land and non-farm demand for land. This would require a carefully refined system of Ontario land policies and corresponding public instruments to achieve social goals.

APPENDIX TO CHAPTER 7

Additional Explanation of Projections Given in Table 47

The projected rates of change of production in the body of Table 46 are calculated from the data and the assumptions presented in the text. The complex relationships can be manipulated into a reduced formula in which the projected rate of change of production is calculated by multiplying the specified projected rate of change of consumption by a factor. In the lower-bound set of projections, the factor takes the form:

$$ZL = \frac{PO}{PO + SE}$$

In the upper-bound set of projections, the different assumptions require the factor:

$$ZU = \frac{PO + SE + PE}{PO + SE}$$

The value of the factor varies according to the specific data assumed or estimated for the 1971 conditions, i.e., the factor is different for the high trade and the low trade assumptions as different 1971 values are used for SE and for PE, and hence for PO as well.

CHAPTER 8

GUIDELINES FOR POLICY

Any attempt to set guidelines for agricultural policy is complicated by the large number of variables involved and a lack of information about many of them and their interactions. In suggesting policy one must consider the possibilities of conflict among major land uses, the demand for food, farm production, population growth, the resource base, profitability and a host of other factors. The authors have analyzed a number of these factors and noted the changes that have occurred over a period of time. This information can be used to set policy guidelines.

In general there is nothing in this report to indicate that agriculture in Southern Ontario is doomed, nor is there any indication that the overall land use position of this province will become extremely difficult in terms of the availability of land for all major uses. There should be enough land for us to use -- but we shall be faced with the constant problem of using it wisely.

The important policy decisions in the future will be those which reduce conflict among competing land uses. We do not see large amounts of agricultural land being used for urban purposes over the next twenty years. Generally there is an amount of developable land within present city boundaries. Even so it is anticipated that all that will be required up to 1991 is an additional 300,000 acres or so -- about 2 percent of the acreage in farms in 1966. In many instances policy can direct urbanization on to low quality agricultural land thereby reducing the total impact of urbanization on agriculture. Of greater concern is the movement of people into the countryside. Spreading rural low density residence is proceeding so rapidly

that there may be some cause for alarm. Rural planning could be overcome by this phenomenon and government policy could do little to protect agriculture in areas where rural non-farm dwellings were numerous.

Faced with an increase in population of about 2% per annum and a possible total population of some 11.5 million or more by 1991, most policy makers are concerned with the amount of land needed by agriculture. Numerous gaps in our knowledge make projection of acreages difficult if not impossible. We can, of course point out the obvious. High quality land, classes 1 and 2, must be reserved for agriculture wherever possible. In addition, some of classes 3, 4 and 5 is needed for extensive farming operations such as livestock raising. Some land of moderate quality for common field crops is very good for the production of tender fruits, tobacco and certain vegetable crops. Policy is then needed to decide the future agricultural use of the Niagara fruit belt, the tobacco areas in Norfolk County and the fruit growing areas around Thornbury in addition to other regions where conflict among uses is occurring or may occur in the future. Reservation of the best land for agriculture assumes the need for maximum productivity per acre which may or may not be a requirement. Also there are certain costs to be borne in mind. What costs are involved in placing settlements on low quality agricultural land? And will lower housing densities, greater personal mobility and more space for recreation be worth the costs of taking greater amounts of land out of agriculture? We have been unable to answer these questions in this study largely because of a lack of information but answers are needed before we can be sure of what constitutes a satisfactory land use balance.

This study indicates that Ontario agriculture can increase in size should economic conditions warrant it. At the moment farm population and the number of farms are decreasing at rather rapid rates. However, these

losses are partly offset by increased farm sizes and what appears to be a resistance to sell improved land. Also there is a considerable increase in the number of part-time farmers. Indeed, part-time farmers embrace 1/3 of the farmland and supply 20% of the total agricultural output. Agricultural policy might take a look at the role of the part-time farmer in Ontario agriculture. There may be a future in which agriculture still uses most of the rural land but does so in a protective rather than an active fashion with maximum agricultural productivity being forfeited in order to create a rural community with a bias toward providing environmental rather than food needs. Part-time farmers could be the rule, rather than the exception under such conditions.

In general we have found that Southern Ontario agriculture is intensifying under a) large and rapid urbanization and b) superior climate and soils. One direction for agricultural policy to take might therefore be to promote the further intensification of agriculture in order that future food demands continue to be met and land demands for other purposes are met as they are needed. There are, of course, certain difficulties inherent in following this kind of policy. One of the major problems is simply one of setting guidelines which can be used to delineate areas in which agriculture is to be intensified and indicating those which could be used for other purposes. Land use can be controlled by master plans, zoning, building codes and the like. If master plans and zoning were explicit, firm, enforceable, and enforced, and if there was confidence they would remain so, land use could be effectively planned. Also land values would be less likely to fluctuate and land speculation would be reduced. Therefore if planning, zoning and similar regulations were taken seriously then the area available at any one time for each kind of use could bear some reasonable relation to the need for land for this use.

The public, acting through government at some level has, at various times, acquired the land it needs for public purposes. In most instances the land purchased in this way has been used for recreation. The A.R.D.A. program of land consolidation and farm enlargement might be modified by increasing the limit on the maximum amount paid for land. Such an increase would allow A.R.D.A. to operate in southwestern Ontario where land values in excess of $150.00 per acre have prevented the branch from conducting its program.

The ultimate in public control over land is achieved only when a public agency acquires all the land from present owners and then sells it to new owners or leases it. However, wholesale public acquisition of land seems most unrealistic but public land acquisition may be helpful in areas of severe land use conflict.

Whatever the problem policy which promotes the intensification of agriculture in order to continue to meet future food demands is probably better than a policy providing environmental rather than food needs. The ideal, of course, is that which provides for both food needs and the provision of an environment of high quality.

CHAPTER 9

CONCLUSIONS

Our study of the agricultural industry of Southern Ontario has revealed that a number of important changes have taken place in the interval between the censuses of 1951 and 1966. Perhaps the most significant has been the rate at which the acreage of land in census farms has decreased over these 15 years. Early tabulations of the 1971 Census of Agriculture which are becoming available now just as this study is concluding suggest that the rate of farmland "loss" since 1966 has accelerated substantially.

There have been no clear indications from the data available to us that the progressively fewer acres being farmed have been responsible up to this time for the appearance of undesirable trends and outcomes in respect to the agricultural productive process taken as a whole. This is largely due to the fact that the land that has been retired from agriculture has been predominantly "unimproved" land. Overall productivity increases that have been measured at above 60 percent over the last 20 years at the same time as land in farms has probably declined by nearly as much as four million acres or over 20 percent are, in consequence, not as dramatic as they would otherwise be.

Notwithstanding the bias toward "unimproved" land in the retirement process, the stock of this class of farmland is obviously not limitless. There may be real dangers that nonfarm demands will increasingly find their satisfaction in the retrenchment of "improved" farmland -- that is, in land which is the foundation of agricultural production. Unfortunately, the preliminary 1971 census data are insufficiently comprehensive for evaluation of this concern: they do not give separate statistics of "improved" and "unimproved" categories. However, they

do indicate a fall since 1966 in the acreage of reported field crops that is greater than any other 5-year decline since the census of 1951.[1] Finally, of course, the agricultural census cannot realistically be expected to be a principal source of data either on the motives behind transfers of land from agriculture to new nonfarm uses or on the nature of the new uses themselves. Any information provided by the censuses of agriculture in this area will continue to be deductive and available only by the analysis of differences. For this reason we regard the collection of statistics relating directly and positively to the emerging uses that are increasingly replacing farming to be a matter of some urgency.

Improved land has represented a higher proportion of the total acreage retired from agriculture in counties and districts of the Shield and in areas where urban expansion pressures have been greatest. We have concluded that a bias in transfers to nonfarm interests that favoured sales of entire farms has been the main factor in explaining this difference. In the first region the relatively low price of land has made whole-farm transactions a feasible proposition for a large population of buyers. In the case of areas that are rapidly urbanizing, the needs of land-market operators are thought to be such that "part-farm" purchases would seldom be made.

Except for the two regions mentioned immediately above we conclude that farmland in an improved state was being held fairly securely as at 1966. We find explanation for this state of affairs in profit

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[1]Field-crop acreages for Ontario actually increased by 4.6 percent between 1961 and 1966. Percent changes for successive 5-year periods since 1951 have been: -4.8% for 1951-1956, -2.9% for 1956-1961, +4.6% for 1961-1966, and -6.3% for 1966-1971. The increase recorded for 1961-1966 in fact, was largely responsible for the 10-year decline between 1961 and 1971 (1.9%) being considerably less than that for 1951-1961 (7.6%).

conditions that, generally speaking, were moderately satisfactory (in part a result of the considerable investment of labour and capital that land improvement in a region that has been subject to glacial drift has commonly required), but also, and probably much more important, in levels of nonfarm demand for this kind of land that were quite weak.

Notwithstanding the above, prices paid for land at the urban periphery and in areas of scenic beauty (or of high amenity value for other reasons) have spilled over and affected the price of land within the agricultural estate proper -- that is, the prime farmland that can be expected to be the basis of Ontario's food production in the years ahead. Our investigation of changes in the value of farmland (including the value of farm buildings) showed that annual increases for a county of eight percent over the entire period 1951-1966 were quite common (although we caution earnestly against unqualified acceptance of this rate of growth because of the nature of the data source). At such a rate of growth farming becomes much more competitive with other forms of economic activity that are more moderate in respect to their requirements for land area. For example, the capital appreciation of the land resource of a fairly typical Ontario farm of 150 acres worth $300 per acre calculates to $3600 at the end of the following 12 months if an eight percent rate of increase in value holds.[1]

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[1] It will be recalled from an earlier chapter that in 1966 the average size of census farms reporting 10 acres and over of improved land was 159.0 acres for the 10 counties located in an arc around Toronto, and 191.2 acres for the 12 counties north-east from Northumberland. An average figure of $300 per acre is probably a fairly conservative estimate of land value for the former group of counties. Of course the increment is normally only realized when the property changes hands.

The price of other groups of farm inputs relative to the price of land has generally declined significantly since World War II, although the index relative of one -- farm wages -- was still above 150 in 1966 (1935-39=100). We see the trend that has occurred toward increasing applications of nonland inputs per acre of farmland during this period as being explained in part by this pattern of price change. We note, however, that the purchase of land is not a recurring annual expense for most farmers and, therefore, that the direct impact of high land prices on substitution among farm inputs can be expected to be restricted to the operations of new recruits to farmer ranks and to those of existing farmers increasing the acreage of their holdings. Even so, the evidence we have found in respect to the strength of the latter -- farm enlargement and consolidation -- is such as to suggest to us that the price of land has indeed been an important factor in influencing change in the agricultural production process in Southern Ontario since the early 1950's.

We associate farm-product prices that have increased less than the general level of "consumption" prices with change in the organizational structure of agriculture in Southern Ontario toward a larger-scale unit and, perhaps, a more corporate form. The data available to us have unfortunately not been particularly helpful in examining the latter aspect of change. However, outlays for farm labour that have declined less in percentage terms than might have been anticipated from our analysis of change in the price of groups of farm inputs since 1935-1939 possibly reflect some substitution of the owner-operator by the hired hand working within the corporate form of business organization. In regard to the first aspect -- scale increases -- the purchase of additional farmland is one possibility. In fact we see such purchases as having introduced a complicating and confusing element into the land-market picture: they

have operated to stimulate a demand for land during the post-war years when we perceive the accent in agricultural land to have been essentially a land-saving one.

A continuing increase in the price of prime farmland that is generally unattractive to the nonfarm buyer except for that very fact (of capital appreciation) will encourage further intensification of agricultural production. In itself such intensification is not necessarily bad. Nevertheless, society is becoming increasingly aware of some of the side effects and rejecting certain production practices that pose a serious risk of environmental depredation. Thus, there are no longer secure guarantees that levels of agricultural output rising in concert with population and per capita real income increases can be maintained on a steadily diminishing land base. We have estimated the most probable range of required food-production increases by 1991 for Ontario to be between about 60 and 90 percent of 1971 levels.

If past trends in agricultural technology must be reversed (or at least modified) in the face of the objections of environmentalists and a larger agricultural land base becomes a necessary development in order to preserve the current status of the industry, the question arises as to the most appropriate land policy for the immediate future. The enormous difference we believe to exist between the acreage retired from farming since the census of 1951 and positive identifiable forms of alternative land use (whether urban, recreation, or rural residence oriented) points very strongly to retrenched land being held largely in an idle or semi-idle state for purposes of speculative gain. Thus the future recapture by agriculture of part of its land base would seem not to be prevented by processes that are physically irreversible, although this will not necessarily hold if, for example, the land resource is fragile and its

ability to produce food depends upon continuous careful husbandry. In such cases depletion of the land resource would seem to be inevitable. Furthermore, price can be seen as presenting an immense obstacle to the reversing of past land-use trends in the event that market forces continue to be allowed free rein.

Future prices for prime agricultural land that increased less rapidly than the general run of farm-input prices would encourage the substitution of land for nonland inputs and, therefore, represent a desirable trend in the eyes of environmentalists. (Existing farmers of course would be less enthusiastic to the extent that capital appreciation was reduced and the entry of new farmers to the industry was facilitated, although farm enlargement could be achieved at lower cost). One way in which a much slower rate of price increase for rural land might be secured would be through increasing the cost of holding land in a state of virtual idleness or by imposing high rates of tax on the profits of speculation. The former suffers from the defect of requiring intentions to be classified, and thus, for example, for illness or other personal hardship of bona fide farmers to be distinguished from absent landlordism. In regard to the latter alternative (for decreasing current rates of increase in rural land values), the effect of recent changes in the tax structure will be watched with great interest. Current rates of capital-gains tax that apply in specified instances may foreseeably dampen land prices considerably.

Increasing the cost and reducing the ease of developing rural residential property poses an alternative method of deflating rural land prices somewhat.

Other possibilities present themselves. One is for the government of Ontario to purchase, in perpetuity, development rights over consolidated blocks of the agricultural estate. Rural land prices within these areas could then be expected to reflect agricultural potential much more closely. Then again, the strength of demand for rural land can be conceived as depending essentially upon the quality of urban living. Making the cities more attractive places for people to live in may, after all, represent the fundamental solution. It is hardly necessary to add that this matter falls well outside the terms of reference of this study. Hopefully, however, the opportunity will arise for the question of development easements to be pursued in some depth in conjunction with the updating of this research that the 1971 census data now make possible.

APPENDIX I

CHANGE IN THE DEFINITION OF A CENSUS FARM

In the 1956 Census of Agriculture a farm was defined as:

> "a holding on which agricultural operations are carried out and which is (1) three acres or more in size, or (2) from one to three acres in size, and with agricultural production in 1955 valued at $250 or more. The holding may consist of a single tract of land or of a number of separate tracts held under the same or different tenures, and operated as a single unit. Where the farm was made up of several parts located in different municipalities, the 1956 Census reported the complete farm as one unit in the municipality where the headquarters were located." (Emphasis has been supplied.)

This definition was the same as that used in the 1951 Census except, of course, for the year for which value of agricultural production was assessed.

The definition was changed for the 1961 and 1966 censuses, but it was identical as between these two years. In the 1966 Census, a census farm was defined as:

> "an agricultural holding of one acre or more with sales of agricultural products, during the 12-month period prior to the census, of $50 or more." (Emphasis has been supplied.)

The same stipulation in respect to fragmented holdings held in 1966 (and in 1961) as it did in 1956 (and in 1951).

For 1951 and 1956 the value of produce grown on the farm and consumed by the farm household (home consumption) was considered to be part of the "value of production". In many instances this component would have exceeded the $250 minimum, so that farms with no sales would have qualified as census farms in both these years. Moreover, there was

a complete absence of qualification for farms that were three acres and larger in area.

It would seem that the definition of a census farm in 1951 and 1956 was more restrictive than in 1961 and 1966 only to the extent that farms of one and up to three acres had levels of home consumption at such a (low) level that sales above $50 were still insufficient for the value criterion to be satisfied. However, it must be conceded that rising produce prices between the 1950's and the 1960's would also have generally worked in favour of a more restrictive earlier definition.

On balance, unpublished county data of Statistics Canada for the 1961 Census suggests a universal decline in farm numbers and acreage solely on the grounds of change in the definition of a census farm between 1956 and 1961. The tabulation below lists for the 45 counties and districts of Southern Ontario the number and acreage of holdings not classified as farms in 1961 that would have been so classified in 1956 had there been no definitional change.

The change in definition had a pronounced effect in Hastings, Muskoka, Parry Sound and Renfrew where agriculture is "extensively" practised. If there is no consideration of this group of four, the average number of farms and acreage excluded per county calculates to 81.3 and 3,345.5 acres, respectively, for the remaining 41 counties. The average size of the excluded farm was thus 41.2 acres for this group.

For the group of four in question (Hastings, Muskoka, Parry Sound, Renfrew) the average number of farms and acreage excluded per county was 144.7 and 15,836.8 acres, respectively. In this case, the average size of the excluded farm was 109.4 acres, or about 2.7 times that for

Farms Excluded by 1961 Definition

County	No.	Acres	County	No.	Acres
Brant	96	2,497	Middlesex	198	5,005
Bruce	80	4,565	Muskoka	126	12,757
Carleton	63	3,986	Norfolk	113	3,427
Dufferin	17	1,400	Northumberland	98	3,635
Dundas	47	2,929	Ontario	87	3,545
Durham	72	2,756	Oxford	75	1,036
Elgin	129	2,247	Parry Sound	73	9,078
Essex	177	1,624	Peel	40	1,532
Frontenac	57	4,433	Perth	33	808
Glengarry	29	1,514	Peterborough	97	5,932
Grenville	122	8,742	Prescott	43	2,031
Grey	105	4,774	Prince Edward	25	951
Haldimand	81	2,876	Renfrew	135	17,074
Haliburton	26	3,243	Russell	39	1,877
Halton	38	1,002	Simcoe	119	5,670
Hastings	245	24,438	Stormont	49	2,358
Huron	34	750	Victoria	52	3,411
Kent	47	534	Waterloo	67	734
Lambton	41	1,068	Welland	259	10,144
Lanark	42	5,091	Wellington	71	2,994
Leeds	105	8,836	Wentworth	110	3,570
Lennox & Add.	79	6,337	York	163	4,958
Lincoln	110	2,343			
			TOTAL	3,914	200,512
			AVERAGE (per county)	87.0	4,455.8

the remaining group of 41. A relative concentration of extremely low-level agriculture in these four counties and districts is suggested by reason of both the number and the large average size of the excluded farm.

For the counties of Southern Ontario excluding Hastings, Muskoka, Parry Sound and Renfrew, the change in the definition of a census farm between 1956 and 1961 was responsible for a decrease of approximately 3.2 percent in the number of census farms that would otherwise have been counted in 1961. Because of the low average size of the "excluded" farm for this group, the corresponding acreage reduction was only 0.9 percent.

APPENDIX II

A NOTE ON SOME METHODOLOGICAL ISSUES AND PRINCIPLES IN RURAL LAND PLANNING[1]

The purpose of this note is to complement the main report, which is devoted to analysis of facts, relationships and trends in order to clarify and identify issues for agricultural land use planning in Southern Ontario. As such, the report is an important component within a complete planning process. This appendix serves a different purpose by presenting a brief outline of a number of propositions and principles in the methodology of planning, especially with respect to comprehensive land planning on the regional scale. One of the major conclusions of the discussion is that rural and regional land planning and plan implementation will require methodological approaches which differ substantially from the methods of city planning, and that important research is needed in these directions. Ontario can be proud of its accomplishments in planning methods, and its initiatives to explore the new challenges. This note stresses the remaining needs in the planning area rather than the vast storehouse of understanding which already has been generated about our land resources.

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[1]This note was published in different form in Notes on Agriculture, Vol. VIII, No. 2, June 1972, Ontario Agricultural College, University of Guelph.

Regional planning has been defined as the process by which society formulates, clarifies and achieves its objectives for the arrangement of activities in supra-urban space.[1] It follows that land must play a central role in regional planning. Each acre of land has its physical and biological aspects, which we tend to think of as "soil" or vegetation, but that acre also has a role as space itself, on which activities may take place, or which may simply keep one activity separated from another activity.

It does make a difference to the human condition how we arrange things on the land. In Ontario, and in many other parts of Canada, most of the issues of regional land planning stem from the growning urban sphere of influence over rural areas and from the fact that there is no forseeable end to the momentum of growth of population and income.

Perhaps the most basic long-run issue in land policy is the adaptability of our land resources to meet future conditions. The next generation may face enormous costs if we carve the countryside into shapes suited only for yesterday's needs or take away too much of nature's self-restorative powers.

The arrangement of activities over the countryside and the staging of future changes cannot be regarded as a zero-sum game; the total benefits which can be enjoyed from our land resource can be made greater or smaller by how we go about using the land.

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[1] John Friedmann and Wm. Alonso. Regional Development and Planning, M.I.T. Press 1964, p. 64.

The profession of planning is so small, so diverse and so weakly recognized that there are inevitable popular misconceptions about the purposes and methods of planning, even about the relatively well established field of city planning. Regional land planning by the government is in the pioneering stage. Despite some significant advances in this work by Canadian scholars and professionals it is still true that there is no established methodology for regional land planning. Given the state of our scientific and creative knowledge it is to be expected that there is a great deal of confusion, fallacy and experimentation on the part of people inside and outside this field of work. Because of the need for many disciplines to contribute to planning in a number of ways, there will continue to be diversity among our emphases and interpretations.

The term "planning" has two meanings; it is applied (a) to the socio-political process by which society defines its policy goals and coordinates its actions towards those goals, and (b) to the work of the planning profession which devotes its' technical, analytical and creative skills to improving the planning process. There is much to be gained by distinguishing these two concepts, and further by recognizing the difference between the work of the progessional planner (who "makes plans") and the several kinds of planning research used by the planner.

Four kinds of interaction between rural land planning and regional development planning can be identified. The propositions which follow will be refined by further research but they are useful generalizations. (1) Policies and plans for regional development will involve some degree of implicit policy for the land resource. (2) A regional development plan must include some consideration of the land

resource, i.e., its physical features, supply and demand relations, ecological interactions, and role in the economic structure. (3) If there is to be comprehensive rural land planning to contain and to guide the economic forces which affect the land resource, it will require a regional scale with at least some provincial elements to support efforts by the local municipality. (4) Rural land planning must recognize a regional development framework. In support of these propositions we can argue that, without a regional-level framework for economic development strategy, it is very likely that a single rural municipality would be unsuccessful in the long run if it attempted to achieve planning goals which departed much from the outcome of real estate market forces. Similarly, it seems clear that it would be futile to attempt to pursue provincial objectives for land entirely through locally drafted plans and local regulations.

The best long-range comprehensive plan for land is not solved by an estimate of either (a) the current best activity for a particular location, or (b) the best location for a specific activity. The latter question can be answered if the activity is a single factory (or farm) of a given kind; however, there is no answer to the question "What is the best location for agriculture?"--because it must be defined more specifically.

It is possible, given the Canada Land Inventory for agriculture, to judge how each area of land compares to other localities in terms of producing general farm crops. This means only that we can see which areas are better at growing crops than other areas are, just as the forestry capability ratings in the Canada Land Inventory (CLI) tell

us that trees grow better in some areas than the grow in other areas. (The CLI has also rated land for its relative capability in wild-life and in outdoor recreation.) Unfortunately it is not possible to follow the same logic for every kind of imaginable land use, and thus we have only these four sets of capability ratings. In any case they cannot tell us what soils or sites in Ontario are best/good/fair/poor/terrible for special farm products such as tobacco, or fruit, or blueberries, or hogs. Nor do we know from the Canada Land Inventory alone which soils are best/fair/terrible for building houses or roads except that we can guess something from some of the features of the agricultural ratings. For example, land rated class 7 for farming is expensive for construction because it is either bare rock or something else disastrously bad, while land in classes 1, 2, and 3 is fairly level, dry, and firm.

Neither the Canada Land Inventory nor any capability rating can tell us the best use for a piece of land. What should we do if a piece of land is rated class 1 for farming, class 1 for forestry, and class 1 for recreation? The CLI was devised to convey one kind of information and we must not unfairly ask it to bear other kinds of burden.

The Canada Land Inventory ratings can be interpreted as indicators of the relative costs of producing the specified group of products, but only if we exclude the price of land from the implicit cost comparison. However vital it is to have that special kind of comparison, it must be recognized that land values reflect important additional considerations in society. The many forces which influence

rural land values have been analysed in Chapter 5; they must be accommodated in any rural plan especially when their effects are not well correlated with the capability ratings.

There is a fundamental difference between a site plan for land and a regional plan for land. A site plan is drawn up with a very specific person's goal in mind, such as the most profitable shopping centre, and its solution is largely a technical matter of finding the best means to that given end.

Technical manipulation or physical management of a resource site to achieve a specific target considers only technical efficiency, unlike economic management of the same site which pursues economic efficiency by more complex decisions reflecting the values of inputs and outputs. Increasingly, society is concluding that even "economic" values do not measure enough of the effects of our actions and hence we have more planning.

Ontario needs a process of planning our land resource, out of which will emerge plans. It would assist, guide, inform, and regulate all of us but it would not decide how each specific acre would be used next year or in twenty years. A plan provides a framework or strategy within which individuals may make decisions and interact based on the results of their decisions. Good planning stresses better decisions, not regulations. Regulations, prohibitions and other negative control devices are virtually inevitable in any meaningful planning system, but they must be supported by positive techniques which encourage people to move in the "right" direction. The best plan is in fact a continuing process of planning, fully based on social values of all kinds,

recognizing our technological powers and our natural resource endowments and environmental sensitivities, fully dynamic.

A land plan will almost always include a system of land zoning; however, the zoning map can only indicate a general strategy, and it cannot specify the future "best" use for each site. A zoning map is not a regional land plan, but it is an important part of the required mechanism. Zoning cannot carry out a land plan, in isolation. Zoning must be complemented by other planning devices and instruments of policy which positively influence the incentives of people so that their behaviour and their choices in the land market conform to the zoning strategy. The term "zoning" is interpreted in varying ways, ranging from the technical control device provided in the Planning Act to a much more vague concept which is essentially the same as a "master plan" in which only general relationships or goals are indicated, such as in the Toronto Centred Region Development Concept of 1971; the preceding sentences use the term "zoning" in the technical sense of a control device.

Land planning may well be quite powerless to correct the mistakes already made. The purpose of planning is to help us prevent future mistakes. Decisions about the use or abuse of land cannot be reversed quickly because some form of immobile investment is involved. If the planners have looked carefully at where we all together are going, they can help us each make our way toward our goals with fewer mistakes or conflicts along the way.

Three major phases in preparing a long-range land plan can be postulated. The designers of the plan first delineate a number of

feasible alternative land-use arrangements, which are quite different from each other. Each of these must then be tested to discover its outcome and the impact of each of its parts. The implications of these outcomes are then evaluated and selection made, using clearly defined general criteria of choosing a social optimum. The policy planner/ designer must then go through the phases again in a cyclic process as the planning process continues into the future and as it suggests new elements. Concurrently, the planner continues to interact with other researchers and, most importantly, the politicians and the public interest groups.

The optimal plan will require that we invent new elements in our policy system and recombine the known elements in new ways so that we can produce a desired whole.

We cannot reach our potential optimum if we assume that our policy opportunities are very narrowly bounded by existing laws, customes and economic conditions.

The plan cannot be generated by specifying performance conditions for each land use, because we cannot ignore the trade-offs among conditions.

Moving from our present condition in small steps may lead to improvement but cannot move us toward the "best" because we must consider quite different kinds of alternative patterns.

The resource planner or regional planner has a more complex task than most other kinds of planner. He must be more concerned with the physical elements of land and activities than the national economic planner. He must be more concerned than the engineer or architect with

how policy instruments such as law and taxes interact with customs in influencing the behaviour of people. He must be sensitive to the values and attitudes of many groups of people, who are not only in disagreement because of their different viewpoints, but who also often have ambivalent and changing feelings about conditions around them.

There is a very great parallelism between the economist and the planner. Both recognize that there is no formula which will produce a land plan, not even the economist's theoretical "social welfare function." Both should approach their central problem in terms of choosing from among alternative outcomes while weighing the benefits and the costs of each situation. Both require large amounts of data from other sciences and disciplines for their analyses, and they often combine their approaches with those of other disciplines. There are communication problems and often mutual suspicion as (a) planners rely (faute de mieux) more on intuition than on science in their creativity, and (b) most economists tend to confine their work to monetary analysis in market situations.

Regional rural land planning in Ontario faces several problems at the level of the decision-making mechanisms. There is a lack of central decision-making and policy with explicit respect to land and to the location of activities. Second, there is a low level or lack of individual participation at the local level, at which people's values should be an essential input for the planning process. Third, there is a lack of decision-making at the scale of the whole urban field of influence, and a corresponding lack of systematic correlation between national and local policies and such regional

decisions as are made. Rural land planning must be related to the scale of the forces which are important, and there can be no doubt of the importance of the demands from the larger urban centres for rural land for many purposes over a wide radius.

There have been substantial changes in the rural land market in the last twenty years. Because of the neglect of our land and spatial resource as an object of study, particularly in the social sciences, we do not know what all these changes are or where they are taking us over the next twenty years. However, this report is a strategically vital step forward in analysing the factors at work and the general patterns which will emerge. Its conclusions indicate that there are alternatives which would serve the human purpose better.

In the total picture of land policy, agriculture has some very special stakes in our land resource and the mechanisms for change. It has been found that optimal land adjustment within agriculture requires a very long-time horizon because of the long farm production planning period and the farm family life cycle. It has been found also that economic analysis for an optimal agricultural land policy requires several kinds of information which are not available. Meanwhile preliminary indications are that the lack of a policy for land is increasing the land market distortions caused by rapid urbanization, at considerable costs in loss of income and reduced agricultural efficiency. Planning looks to the future, to help us prepare what is to happen.

The process of designing rural land plans and policies has been started and although Ontario is further along the road than most other parts of North America, we have scarcely gone further than some

reconnaissance to see what kind of road lies ahead. Some essential needs have been identified and they fall into four categories: (a) needs for information and research to identify the factors which will determine our land uses and the relations among those factors, (b) needs for methodologies suitable to this entirely new intellectual task of land planning at the regional scale, (c) needs for new social institutions and methods to find out what attitudes, values and objectives people really have, and (d) needs for new techniques and policy instruments (andlegislation) to carry out the findings of the planning process.

There are no systematic data on the actual values of production and consumption supported by land in various uses, nor on the relation of values to site features. There is no measurement of the land areas used for rural non-farm activities, and no measurement of the agricultural capability of the land which is being sold by farmers, nor knowledge of why farmers sell certain parts of their land instead of other parts. There is little comprehensive information about the features which are of value to potential non-farm uses of the land. In other words, there is relatively little measurement of the parameters of the supply of and demands for land resources, and there are available very few estimates of the trends in the demands for land.

It has been found in the research that optimal land planning will require comprehensive evidence as to the attitudes of farm and other rural people about the kinds of change that are taking place or could take place in the forseeable future. Similarly, there is little known about the objectives of the people who are buying rural land and,

whether their objectives can be made compatible with those of the agricultural community or of the whole of Ontario's interests.

The best instruments for implementing social objectives and long-range plans for land under Ontario conditions are unknown because rural regional land planning is almost unknown in North America. There are major problems in interpreting European methods and successes because there are differences in social attitudes and awareness of the rural landscape.

Rural land planning is concerned with the total future environment, with its components of (a) natural resource systems of land, air, water, plant and animals, (b) our community resources of homes, roads, schools and all of our built environment, (c) our social resources, i.e., our social institutions and our community objectives, and (d) our human resources with our personal skills, health, values and individual objectives in living.

Many of the issues have been identified in our research. Much more is now understood of the processes of change. We have examined the state of existing knowledge and seen where new contributions can be made. The effort has been started.